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TEST REPORT

ACCORDING TO: FCC CFR 47 Part 15 subpart C, section 15.231

FOR:
Essence Security International Ltd.
Jamming Detector
Model:ES700JD-ES-M02
FCC ID:YXG-ES700JD

This report is in conformity with ISO/ IEC 17025. The "A2LA Accredited" symbol endorsement applies only to the tests and calibrations that are listed in the scope of Hermon Laboratories accreditation. The test results relate only to the items tested. This test report shall not be reproduced in any form except in full with the written approval of Hermon Laboratories Ltd.

Table of contents

| | | |
|-----|---|----|
| 1 | Applicant information..... | 3 |
| 2 | Equipment under test attributes | 3 |
| 3 | Manufacturer information | 3 |
| 4 | Test details..... | 3 |
| 5 | Tests summary..... | 4 |
| 6 | EUT description..... | 5 |
| 6.1 | General information..... | 5 |
| 6.2 | Test configuration..... | 5 |
| 6.3 | Changes made in EUT..... | 5 |
| 6.4 | Transmitter characteristics | 6 |
| 7 | Transmitter tests according to 47CFR part 15 subpart C requirements | 7 |
| 7.1 | Periodic operation requirements | 7 |
| 7.2 | Field strength of emissions..... | 12 |
| 7.3 | Occupied bandwidth test..... | 27 |
| 7.4 | Conducted emissions..... | 30 |
| 7.5 | Antenna requirements..... | 33 |
| 8 | APPENDIX A Test equipment and ancillaries used for tests..... | 34 |
| 9 | APPENDIX B Measurement uncertainties..... | 36 |
| 10 | APPENDIX C Test laboratory description | 37 |
| 11 | APPENDIX D Specification references | 37 |
| 12 | APPENDIX E Test equipment correction factors..... | 38 |
| 13 | APPENDIX F Abbreviations and acronyms..... | 52 |

1 Applicant information

Client name: Essence Security International Ltd.
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Telephone: +972 7324 47735
Fax: +972 9772 9962
E-mail: israelgo@essence-grp.com
Contact name: Mr. Israel Gottesman

2 Equipment under test attributes

Product name: Jamming Detector
Product type: Transceiver
Model(s): ES700JD-ES-M02
Serial number: 3714094200002F1D
Hardware version: 2
Software release: 4.1
Receipt date 18-Aug-16

3 Manufacturer information

Manufacturer name: Essence Security International Ltd.
Address: 12 Abba Eban avenue, Ackerstein Tower Bldg. D, P.O.Box 2073, Herzliya 4612001, Israel
Telephone: +972 7324 47735
Fax: +972 9772 9962
E-Mail: israelgo@essence-grp.com
Contact name: Mr. Israel Gottesman

4 Test details





Project ID: 28533
Location: Primary: Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel
Satellite: Hermon Laboratories Ltd. Hefetz-Haim 10, Tel Aviv 6744124, Israel
Test started: 18-Aug-16
Test completed: 29-Aug-16
Test specification(s): FCC 47CFR part 15, subpart C, §15.231

5 Tests summary

| Test | Status |
|--|--------|
| Transmitter characteristics | |
| FCC Part 15, Section 231(a), Periodic operation requirements | Pass |
| FCC Part 15, Section 231(a), Field strength of emissions | Pass |
| FCC Part 15, Section 231(c), Occupied bandwidth | Pass |
| FCC Part 15, Section 207, Conducted emission | Pass |
| FCC Part 15, Section 203, Antenna requirements | Pass |

Testing was completed against all relevant requirements of the test standard. The results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

This test report supersedes the previously issued test report identified by Doc ID:ESSRAD_FCC.28533_rev1.

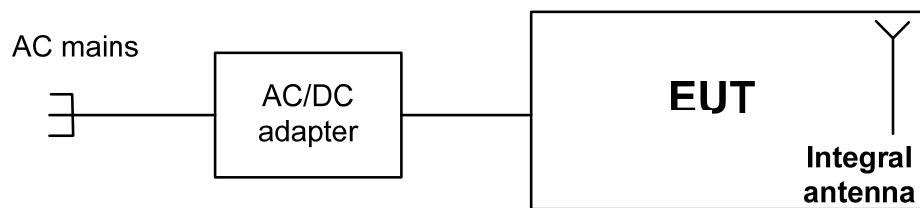
| | Name and Title | Date | Signature |
|---------------------|--|------------------|---|
| Tested by: | Mr. I. Zilberstein, test engineer | August 29, 2016 |  |
| | Mr. K. Zushchuk, test engineer | |  |
| Reviewed by: | Mrs. M. Cherniavsky, certification engineer | October 13, 2016 |  |
| Approved by: | Mr. M. Nikishin, EMC and Radio group manager | October 13, 2016 |  |

6 EUT description

6.1 General information

The EUT, ES700JD-ES-M02, is a Jamming Detector with backup communication channel mechanism. The EUT operates at 916.5 MHz. The EUT is powered from AC mains via external 120 AC/5 VDC adapter.

6.2 Test configuration



6.3 Changes made in EUT

No changes were implemented in the EUT during testing.



6.4 Transmitter characteristics

| | | | | |
|---|--|---|--|-----|
| Type of equipment | | | | |
| X | Stand-alone (Equipment with or without its own control provisions) | | | |
| | Combined equipment (Equipment where the radio part is fully integrated within another type of equipment) | | | |
| | Plug-in card (Equipment intended for a variety of host systems) | | | |
| Operating frequencies | | 916.5 MHz | | |
| Maximum rated output power | | At transmitter 50 Ω RF output connector | dBm | |
| | | Field strength at 3 m distance | 97.44 dB(μV/m) -peak 73.96 dB(μV/m)-average | |
| Is transmitter output power variable? | | X | No | |
| | | Yes | continuous variable | |
| | | | stepped variable with stepsize | dB |
| | | | minimum RF power | dBm |
| | maximum RF power | dBm | | |
| Antenna connection | | | | |
| unique coupling | standard connector | X | integral | |
| | | | with temporary RF connector | |
| | | | X without temporary RF connector | |
| Antenna/s technical characteristics | | | | |
| Type | Manufacturer | Model number | Gain | |
| Integral | Essence Security | Printed | 3 dBi | |
| Type of modulation | | 2FSK | | |
| Transmitter aggregate data rate/s | | 38.4 kbps | | |
| Transmitter power source | | | | |
| | Battery | Nominal rated voltage | Battery type Lithium | |
| | DC | Nominal rated voltage | | |
| X | AC mains | Nominal rated voltage | 120 VAC via AC/DC adapter Frequency 60 Hz | |
| Common power source for transmitter and receiver | | X | yes no | |



| | | | |
|---|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(a), Periodic operation requirements | | | |
| Test procedure: Supplier declaration | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 29-Aug-16 | | | |
| Temperature: 26 °C | Relative Humidity: 42 % | Air Pressure: 1010 hPa | Power: 120 VAC |
| Remarks: | | | |

7 Transmitter tests according to 47CFR part 15 subpart C requirements

7.1 Periodic operation requirements

7.1.1 General

The EUT was verified for compliance with periodic operation requirements listed below:

- Continuous transmissions such as voice, video and the radio control of toys are not permitted;
- A manually operated transmitter shall employ switch that will automatically deactivate the transmitter within not more than 5 seconds of being released;
- A transmitter activated automatically shall cease transmission within 5 seconds after activation;
- Periodic transmissions, excluding polling or supervision transmissions, at regular predetermined intervals are not permitted;
- Total duration of polling or supervision transmissions, including data, to determine system integrity in security or safety applications shall not exceed 2 seconds per hour;
- Transmission of set-up information for security systems may exceed the transmission duration limits of 5 seconds, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

The rationale for compliance with the above requirements was either test results or supplier declaration. The summary of results is provided in Table 7.1.1.

7.1.2 Test procedure for transmitter shut down test

7.1.2.1 The EUT was set up as shown in Figure 7.1.1.

7.1.2.2 The spectrum analyzer center frequency was adjusted to the EUT carrier, span set to zero and video triggered for transmission.

7.1.2.3 The transmitter was activated either manually or automatically. Once manually operated transmitter was activated, the switch was immediately released.

7.1.2.4 The transmission time was captured and shown in Plot 7.1.1.

7.1.3 Test procedure for measurements of polling / supervision transmission duration

7.1.3.1 The EUT was set up as shown in Figure 7.1.1.

7.1.3.2 The spectrum analyzer center frequency was adjusted to the EUT carrier, span set to zero and video triggered for transmission.

7.1.3.3 The transmission time was captured and shown in Plot 7.1.2 to Plot 7.1.4.

Figure 7.1.1 Setup for transmitter shut down test



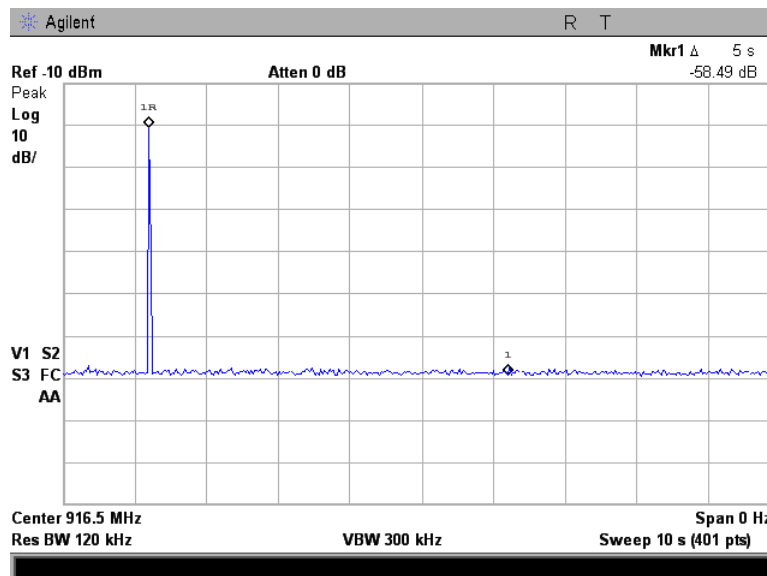


| | | | |
|---|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(a), Periodic operation requirements | | | |
| Test procedure: Supplier declaration | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 29-Aug-16 | | | |
| Temperature: 26 °C | Relative Humidity: 42 % | Air Pressure: 1010 hPa | Power: 120 VAC |
| Remarks: | | | |

Table 7.1.1 Periodic operation requirements

| Requirement | Rationale | Verdict |
|---|------------------------------------|---------|
| Continuous transmissions are not permitted | Supplier declaration | Comply |
| A manually operated transmitter shall be deactivated within not more than 5 seconds of switch being released | NA | NA |
| Transmitter activated automatically shall cease transmission within 5 seconds | Plot 7.1.1 | Comply |
| Periodic transmissions at regular predetermined intervals are not permitted | Supplier declaration | Comply |
| Total duration of polling or supervision transmissions shall not exceed 2 seconds per hour | Plot 7.1.2, Plot 7.1.3, Plot 7.1.4 | Comply |
| Transmission of set-up information for security systems may exceed the transmission duration limits of 5 seconds, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data. | Supplier declaration | Comply |

Plot 7.1.1 Transmitter shut down test result

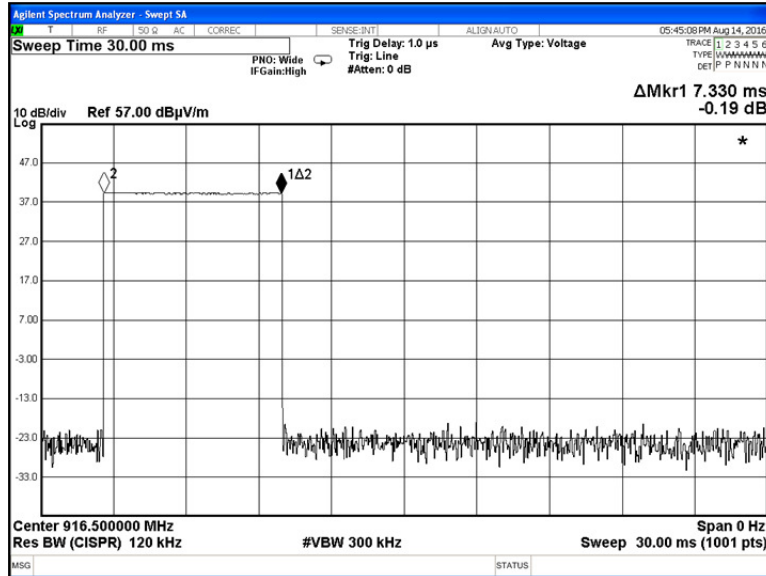




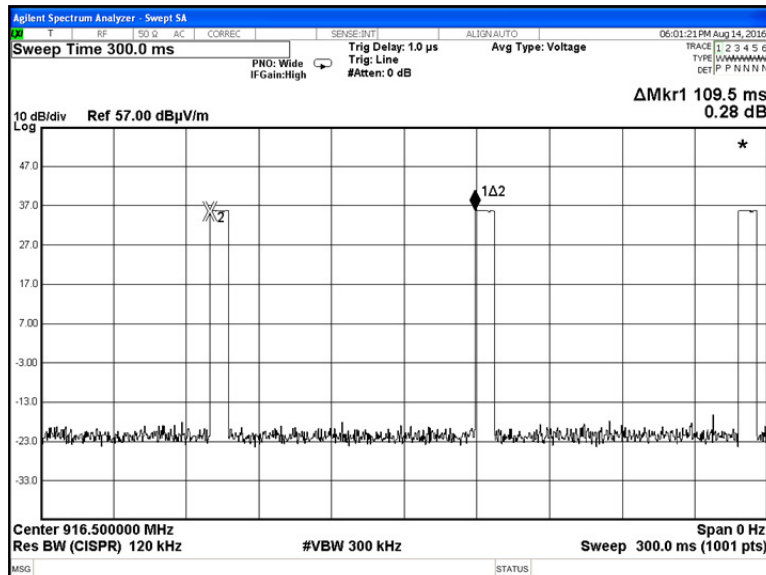
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| | | | |
|---|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(a), Periodic operation requirements | | | |
| Test procedure: Supplier declaration | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 29-Aug-16 | | | |
| Temperature: 26 °C | Relative Humidity: 42 % | Air Pressure: 1010 hPa | Power: 120 VAC |
| Remarks: | | | |

Plot 7.1.2 Polling / supervision pulse duration



Plot 7.1.3 Polling / supervision burst duration (one transmission)

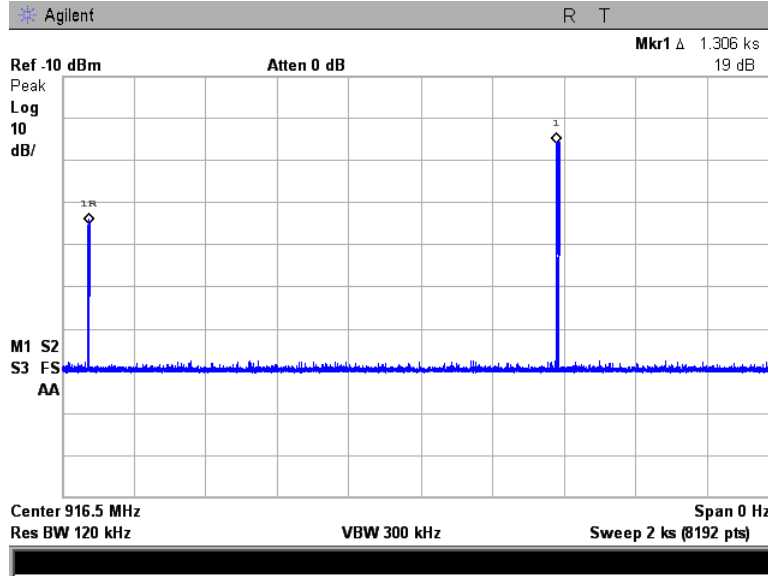




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| | | | |
|---|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(a), Periodic operation requirements | | | |
| Test procedure: Supplier declaration | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 29-Aug-16 | | | |
| Temperature: 26 °C | Relative Humidity: 42 % | Air Pressure: 1010 hPa | Power: 120 VAC |
| Remarks: | | | |

Plot 7.1.4 Polling / supervision transmission period





| | | | |
|---|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(a), Periodic operation requirements | | | |
| Test procedure: Supplier declaration | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 29-Aug-16 | | | |
| Temperature: 26 °C | Relative Humidity: 42 % | Air Pressure: 1010 hPa | Power: 120 VAC |
| Remarks: | | | |

Table 7.1.2 Total duration of polling / supervision transmissions

| Pulse duration, ms | Number of pulses in the burst | Maximum number of transmissions (bursts) within 1 hour | Total duration within 1 hour, ms |
|--------------------|-------------------------------|--|----------------------------------|
| 7.33 | 3 | 3 | 65.97 |

Reference numbers of test equipment used

| | | | | | | |
|---------|--|--|--|--|--|--|
| HL 4663 | | | | | | |
|---------|--|--|--|--|--|--|

Full description is given in Appendix A.



| | | | |
|---|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(b), Field strength of emissions | | | |
| Test procedure: ANSI C63.10 sections 6.5, 6.6 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 21-Aug-16 | | | |
| Temperature: 27 °C | Relative Humidity: 52 % | Air Pressure: 1008 hPa | Power: 120 VAC |
| Remarks: | | | |

7.2 Field strength of emissions

7.2.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given in Table 7.2.1 and Table 7.2.2.

Table 7.2.1 Radiated fundamental emission limits

| Fundamental frequency, MHz | Field strength at 3 m, dB(μV/m) | |
|----------------------------|---------------------------------|---------|
| | Peak | Average |
| 916.50 | 102.0 | 82.0 |

Table 7.2.2 Radiated spurious emissions limits

| Frequency, MHz | Field strength at 3 m, dB(μV/m) | | | | |
|----------------|---------------------------------|-----------------|-----------------|--------------------------|---------|
| | Within restricted bands | | | Outside restricted bands | |
| | Peak | Quasi Peak | Average | Peak | Average |
| 0.009 – 0.090 | 148.5 – 128.5 | NA | 128.5 – 108.5** | 82.0 | 62.0 |
| 0.090 – 0.110 | NA | 108.5 – 106.8** | NA | | |
| 0.110 – 0.490 | 126.8 – 113.8 | NA | 106.8 – 93.8** | | |
| 0.490 – 1.705 | NA | 73.8 – 63.0** | NA | | |
| 1.705 – 30.0* | | 69.5 | | | |
| 30 – 88 | | 40.0 | | | |
| 88 – 216 | | 43.5 | | | |
| 216 – 960 | | 46.0 | | | |
| 960 - 1000 | | 54.0 | | | |
| Above 1000 | 74.0 | NA | 54.0 | | |

*- The limit for 3 m test distance was calculated using the inverse square distance extrapolation factor as follows:

$$Lim_{S2} = Lim_{S1} + 40 \log (S_1/S_2),$$

where S₁ and S₂ – standard defined and test distance respectively in meters.

**- The limit decreases linearly with the logarithm of frequency.

Note 1: The fundamental emission limit in dB(μV/m) was calculated as follows:

$$Lim_{AVR} = 20 \times \log(56.81818 \times F - 6136.3636) \text{ - within } 130 - 174 \text{ MHz band;}$$

$$Lim_{AVR} = 20 \times \log(41.6667 \times F - 7083.3333) \text{ - within } 260 - 470 \text{ MHz band,}$$

where F is the carrier frequency in MHz.

The limit for spurious emissions was 20 dB lower than fundamental emission limit.

The above limits provided in terms of average values, peak limit was 20 dB above the average limit.

Note 2: The above field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency.



| | | | |
|---|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(b), Field strength of emissions | | | |
| Test procedure: ANSI C63.10 sections 6.5, 6.6 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 21-Aug-16 | | | |
| Temperature: 27 °C | Relative Humidity: 52 % | Air Pressure: 1008 hPa | Power: 120 VAC |
| Remarks: | | | |

7.2.2 Test procedure for spurious emission field strength measurements in 9 kHz to 30 MHz band

7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and the performance check was conducted.

7.2.2.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360° and the measuring antenna was rotated around its vertical axis.

7.2.2.3 The worst test results (the lowest margins) were recorded in Table 7.2.3, Table 7.2.5 and shown in the associated plots.

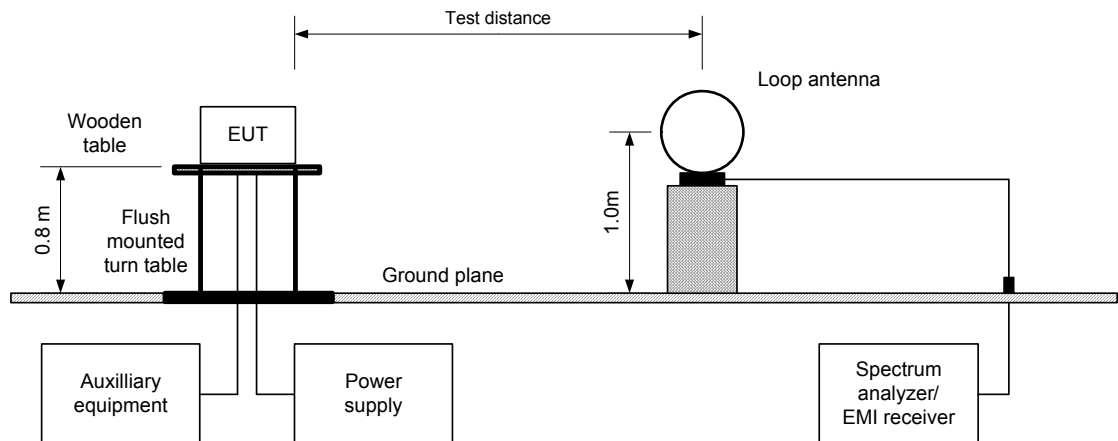
7.2.3 Test procedure for spurious emission field strength measurements above 30 MHz

7.2.3.1 The EUT was set up as shown in Figure 7.2.2, Figure 7.2.3, energized and the performance check was conducted.

7.2.3.2 The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.

7.2.3.3 The worst test results (the lowest margins) were recorded in Table 7.2.3, Table 7.2.5 and shown in the associated plots.

Figure 7.2.1 Setup for spurious emission field strength measurements below 30 MHz





| | | | |
|---|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(b), Field strength of emissions | | | |
| Test procedure: ANSI C63.10 sections 6.5, 6.6 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 21-Aug-16 | | | |
| Temperature: 27 °C | Relative Humidity: 52 % | Air Pressure: 1008 hPa | Power: 120 VAC |
| Remarks: | | | |

Figure 7.2.2 Setup for spurious emission field strength measurements in 30 – 1000 MHz

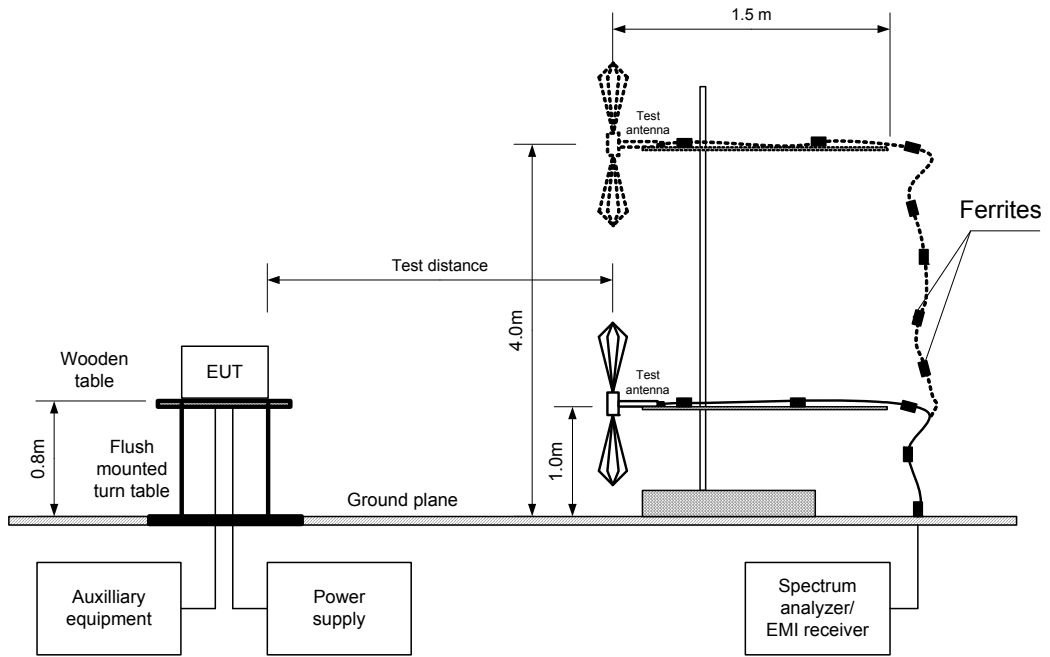
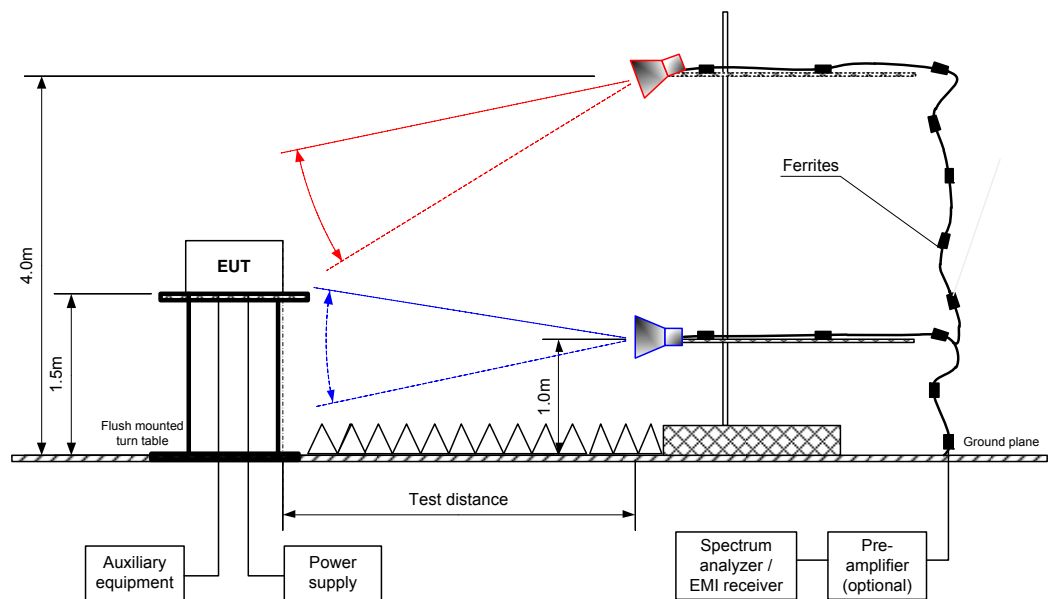


Figure 7.2.3 Setup for spurious emission field strength measurements above 1000 MHz





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| | | | |
|---|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(b), Field strength of emissions | | | |
| Test procedure: ANSI C63.10 sections 6.5, 6.6 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 21-Aug-16 | | | |
| Temperature: 27 °C | Relative Humidity: 52 % | Air Pressure: 1008 hPa | Power: 120 VAC |
| Remarks: | | | |

Table 7.2.3 Field strength of fundamental emission, spurious emissions outside restricted bands and within restricted bands at frequencies above 1 GHz

TEST DISTANCE: 3 m
 EUT POSITION: Typical (Vertical)
 MODULATION: 2FSK
 BIT RATE: 38.4 kbps
 INVESTIGATED FREQUENCY RANGE: 0.009 -10000 MHz
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 0.2 kHz (9 kHz – 150 kHz)
 9.0 kHz (150 kHz – 30 MHz)
 120 kHz (30 MHz – 1000 MHz)
 1.0 MHz (above 1000 MHz)
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 Biconilog (30 MHz – 1000 MHz)
 Double ridged guide (above 1000 MHz)

| F, MHz | Antenna | | Azimuth, degrees* | Peak field strength | | | Average field strength | | | Verdict | |
|--------------------------------|---------|-----------|-------------------|---------------------|-----------------|--------------|------------------------|----------------------|-----------------|---------|--------------|
| | Pol. | Height, m | | Measured, dB(μV/m) | Limit, dB(μV/m) | Margin, dB** | Measured, dB(μV/m) | Calculated, dB(μV/m) | Limit, dB(μV/m) | | Margin, dB** |
| Fundamental emission*** | | | | | | | | | | | |
| 916.50 | V | 1.5 | 0 | 97.44 | 102.00 | -4.56 | 97.44 | 74.74 | 82.0 | -7.26 | Pass |
| Spurious emissions | | | | | | | | | | | |
| 49.97 | V | 1.0 | 0 | 23.59 | 82.00 | -58.41 | 23.59 | NA | 62.00 | -38.41 | Pass |
| 79.60 | V | 1.4 | 360 | 24.59 | 82.00 | -57.41 | 24.59 | NA | 62.00 | -37.41 | |
| 92.86 | V | 1.0 | 145 | 30.32 | 82.00 | -51.68 | 30.32 | NA | 62.00 | -31.68 | |
| 600.00 | V | 1.0 | 290 | 27.94 | 82.00 | -54.06 | 27.94 | NA | 62.00 | -34.06 | |
| 890.49 | V | 1.5 | 344 | 40.18 | 82.00 | -41.82 | 40.18 | NA | 62.00 | -21.82 | |
| 1832.945 | V | 1.5 | 40 | 45.87 | 82.00 | -36.13 | 45.87 | 23.17 | 62.00 | -38.83 | |
| 2749.690 | H | 1.6 | 0 | 36.52 | 74.00 | -37.48 | 36.52 | 13.82 | 54.00 | -40.18 | |
| 5499.095 | V | 1.5 | 20 | 43.75 | 82.00 | -38.25 | 43.75 | 21.05 | 62.00 | -40.95 | |

Measured field strength, (dBμV/m) = meter reading (dBμV) + antenna correction factor (dB/m) +cable loss (dB) – pre-amp (dB), all correction factors were programmed into the spectrum analyzer.

- *- EUT front panel refers to 0 degrees position of turntable.
- **- Margin, dB =Measured (calculated) value, dB(μV/m)-Limit, dB(μV/m)
- *** Max value was obtained at Unom input power voltage.

Table 7.2.4 Average factor calculation

| Transmission pulse | | Transmission burst | | Transmission train duration, ms | Average factor, dB |
|--------------------|------------|--------------------|------------|---------------------------------|--------------------|
| Duration, ms | Period, ms | Duration, ms | Period, ms | | |
| 7.33 | 109.5 | N/A | N/A | N/A | -22.70 |

*- Average factor was calculated as follows

for pulse train shorter than 100 ms:
$$Average\ factor = 20 \times \log_{10} \left(\frac{Pulse\ duration}{Pulse\ period} \times \frac{Burst\ duration}{Train\ duration} \times Number\ of\ bursts\ within\ pulse\ train \right)$$

for pulse train longer than 100 ms:
$$Average\ factor = 20 \times \log_{10} \left(\frac{Pulse\ duration}{Pulse\ period} \times \frac{Burst\ duration}{100\ ms} \times Number\ of\ bursts\ within\ 100\ ms \right)$$

Reference numbers of test equipment used

| | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|
| HL 0415 | HL 0566 | HL 0583 | HL 1915 | HL 2432 | HL 2780 | HL 4294 | HL 4295 |
| HL 4535 | HL 4541 | HL 4542 | HL 4543 | HL 4549 | HL 4551 | HL 4575 | HL 4603 |
| HL 4604 | | | | | | | |

Full description is given in Appendix A.



| | | | |
|---|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(b), Field strength of emissions | | | |
| Test procedure: ANSI C63.10 sections 6.5, 6.6 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 21-Aug-16 | | | |
| Temperature: 27 °C | Relative Humidity: 52 % | Air Pressure: 1008 hPa | Power: 120 VAC |
| Remarks: | | | |

Table 7.2.5 Field strength of emissions below 1 GHz within restricted bands

TEST DISTANCE: 3 m
 EUT POSITION: Typical (Vertical)
 MODULATION: 2FSK
 BIT RATE: 38.4 kbps
 INVESTIGATED FREQUENCY RANGE: 0.009 -10000 MHz
 DETECTOR USED: Peak
 RESOLUTION BANDWIDTH: 0.2 kHz (9 kHz – 150 kHz)
 9.0 kHz (150 kHz – 30 MHz)
 120 kHz (30 MHz – 1000 MHz)
 1.0 MHz (above 1000 MHz)
 VIDEO BANDWIDTH: ≥ Resolution bandwidth
 TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)
 Biconilog (30 MHz – 1000 MHz)
 Double ridged guide (above 1000 MHz)

| Frequency, MHz | Peak emission, dB(µV/m) | Quasi-peak | | | Antenna polarization | Antenna height, m | Turn-table position**, degrees | Verdict |
|-------------------------|-------------------------|-----------------------------|-----------------|-------------|----------------------|-------------------|--------------------------------|---------|
| | | Measured emission, dB(µV/m) | Limit, dB(µV/m) | Margin, dB* | | | | |
| No emissions were found | | | | | | | | Pass |

*- Margin = Measured emission - specification limit.
 **- EUT front panel refer to 0 degrees position of turntable.

Reference numbers of test equipment used

| | | | | | | | |
|---------|---------|---------|---------|---------|---------|---------|---------|
| HL 0415 | HL 0566 | HL 0583 | HL 1915 | HL 2780 | HL 4294 | HL 4295 | HL 4535 |
| HL 4541 | HL 4542 | HL 4543 | HL 4549 | HL 4551 | HL 4575 | HL 4604 | |

Full description is given in Appendix A.



| | | | |
|---|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(b), Field strength of emissions | | | |
| Test procedure: ANSI C63.10 sections 6.5, 6.6 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 21-Aug-16 | | | |
| Temperature: 27 °C | Relative Humidity: 52 % | Air Pressure: 1008 hPa | Power: 120 VAC |
| Remarks: | | | |

Table 7.2.6 Restricted bands according to FCC 15, Section 205

| MHz | MHz | MHz | MHz | MHz | GHz |
|-------------------|---------------------|-----------------------|-----------------|---------------|---------------|
| 0.09 - 0.11 | 8.37625 - 8.38675 | 73 - 74.6 | 399.9 - 410 | 2690 - 2900 | 10.6 - 12.7 |
| 0.495 - 0.505 | 8.41425 - 8.41475 | 74.8 - 75.2 | 608 - 614 | 3260 - 3267 | 13.25 - 13.4 |
| 2.1735 - 2.1905 | 12.290 - 12.293 | 108 - 121.94 | 960 - 1240 | 3332 - 3339 | 14.47 - 14.5 |
| 4.125 - 4.128 | 12.51975 - 12.52025 | 123 - 138 | 1300 - 1427 | 3345.8 - 3358 | 15.35 - 16.2 |
| 4.17725 - 4.17775 | 12.57675 - 12.57725 | 149.9 - 150.05 | 1435 - 1626.5 | 3600 - 4400 | 17.7 - 21.4 |
| 4.20725 - 4.20775 | 13.36 - 13.41 | 156.52475 - 156.52525 | 1645.5 - 1646.5 | 4500 - 5150 | 22.01 - 23.12 |
| 6.215 - 6.218 | 16.420 - 16.423 | 156.7 - 156.9 | 1660 - 1710 | 5350 - 5460 | 23.6 - 24 |
| 6.26775 - 6.26825 | 16.69475 - 16.69525 | 162.0125 - 167.17 | 1718.8 - 1722.2 | 7250 - 7750 | 31.2 - 31.8 |
| 6.31175 - 6.31225 | 16.80425 - 16.80475 | 167.72 - 173.2 | 2200 - 2300 | 8025 - 8500 | 36.43 - 36.5 |
| 8.291 - 8.294 | 25.5 - 25.67 | 240 - 285 | 2310 - 2390 | 9000 - 9200 | Above 38.6 |
| 8.362 - 8.366 | 37.5 - 38.25 | 322 - 335.4 | 2483.5 - 2500 | 9300 - 9500 | |

Table 7.2.7 Restricted bands according to RSS-Gen, Table 3

| MHz | MHz | MHz | MHz | MHz | GHz |
|-------------------|---------------------|-----------------------|-----------------|---------------|---------------|
| 0.09 - 0.11 | 8.291 - 8.294 | 16.80425 - 16.80475 | 399.9 - 410 | 3260 - 3267 | 10.6 - 12.7 |
| 2.1735 - 2.190 | 8.362 - 8.366 | 25.5 - 25.67 | 608 - 614 | 3332 - 3339 | 13.25 - 13.4 |
| 3.020 - 3.026 | 8.37625 - 8.38675 | 37.5 - 38.25 | 960 - 1427 | 3345.8 - 3358 | 14.47 - 14.5 |
| 4.125 - 4.128 | 8.41425 - 8.41475 | 73 - 74.6 | 1435 - 1626.5 | 3500 - 4400 | 15.35 - 16.2 |
| 4.17725 - 4.17775 | 12.290 - 12.293 | 74.8 - 75.2 | 1645.5 - 1646.5 | 4500 - 5150 | 17.7 - 21.4 |
| 4.20725 - 4.20775 | 12.51975 - 12.52025 | 108 - 138 | 1660 - 1710 | 5350 - 5460 | 22.01 - 23.12 |
| 5.677 - 5.683 | 12.57675 - 12.57725 | 156.52475 - 156.52525 | 1718.8 - 1722.2 | 7250 - 7750 | 23.6 - 24.0 |
| 6.215 - 6.218 | 13.36 - 13.41 | 156.7 - 156.9 | 2200 - 2300 | 8025 - 8500 | 31.2 - 31.8 |
| 6.26775 - 6.26825 | 16.42 - 16.423 | 240 - 285 | 2310 - 2390 | 9000 - 9200 | 36.43 - 36.5 |
| 6.31175 - 6.31225 | 16.69475 - 16.69525 | 322 - 335.4 | 2655 - 2900 | 9300 - 9500 | Above 38.6 |

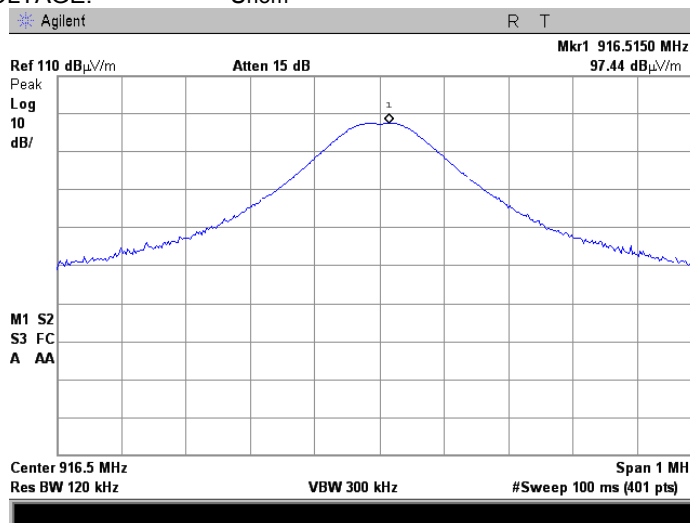


HERMON LABORATORIES

| | | | |
|---|-------------------------|------------------------|----------------|
| Test specification: FCC Part 15, Section 231(b), Field strength of emissions | | | |
| Test procedure: ANSI C63.10 sections 6.5, 6.6 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 21-Aug-16 | | | |
| Temperature: 27 °C | Relative Humidity: 52 % | Air Pressure: 1008 hPa | Power: 120 VAC |
| Remarks: | | | |

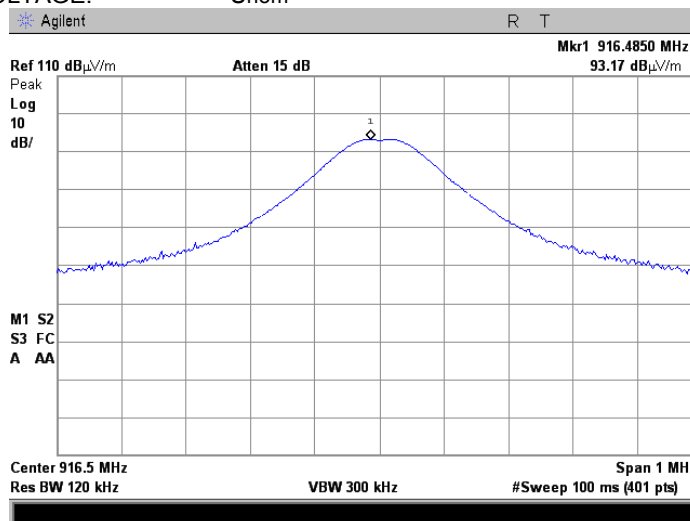
Plot 7.2.1 Radiated emission measurements at the fundamental frequency

TEST SITE: OATS
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical
 EUT POSITION: Typical (Vertical)
 INPUT VOLTAGE: Unom



Plot 7.2.2 Radiated emission measurements at the fundamental frequency

TEST SITE: OATS
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Horizontal
 EUT POSITION: Typical (Vertical)
 INPUT VOLTAGE: Unom



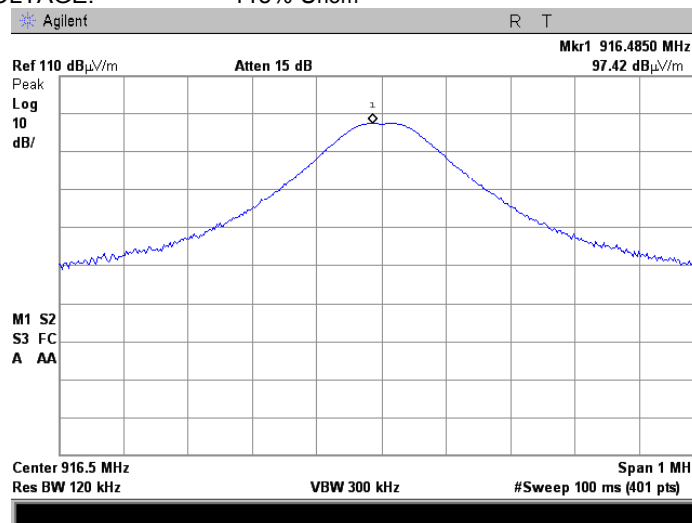


HERMON LABORATORIES

| | | | |
|---|-------------------------|------------------------|----------------|
| Test specification: FCC Part 15, Section 231(b), Field strength of emissions | | | |
| Test procedure: ANSI C63.10 sections 6.5, 6.6 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 21-Aug-16 | | | |
| Temperature: 27 °C | Relative Humidity: 52 % | Air Pressure: 1008 hPa | Power: 120 VAC |
| Remarks: | | | |

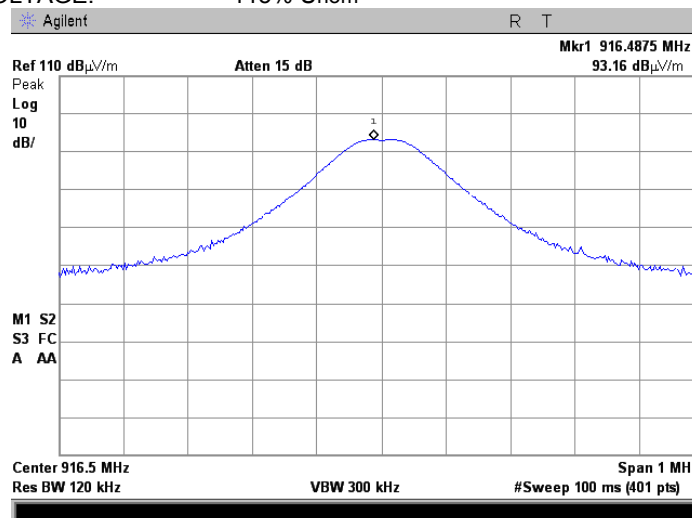
Plot 7.2.3 Radiated emission measurements at the fundamental frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)
INPUT VOLTAGE: 115% Unom



Plot 7.2.4 Radiated emission measurements at the fundamental frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)
INPUT VOLTAGE: 115% Unom



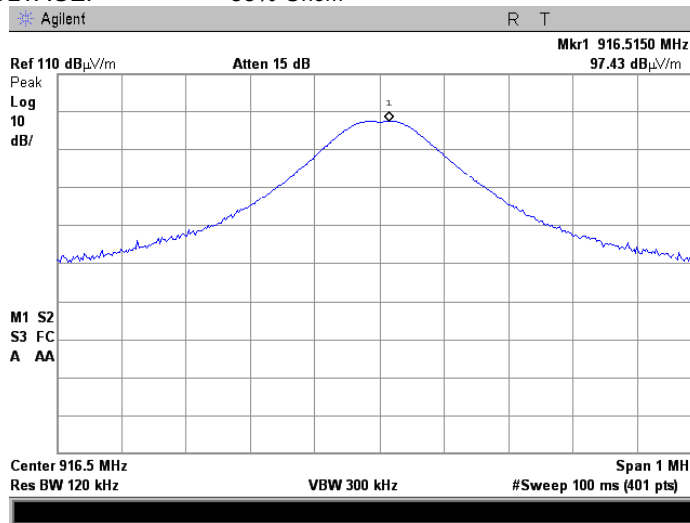


HERMON LABORATORIES

| | | | |
|---|-------------------------|------------------------|----------------|
| Test specification: FCC Part 15, Section 231(b), Field strength of emissions | | | |
| Test procedure: ANSI C63.10 sections 6.5, 6.6 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 21-Aug-16 | | | |
| Temperature: 27 °C | Relative Humidity: 52 % | Air Pressure: 1008 hPa | Power: 120 VAC |
| Remarks: | | | |

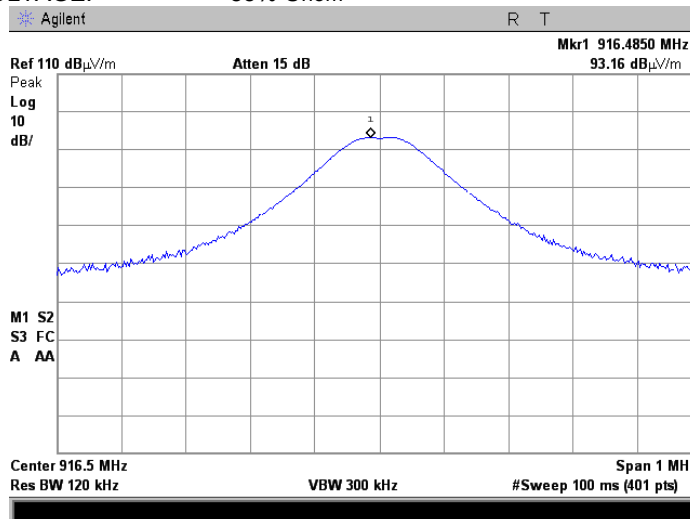
Plot 7.2.5 Radiated emission measurements at the fundamental frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)
INPUT VOLTAGE: 85% Unom



Plot 7.2.6 Radiated emission measurements at the fundamental frequency

TEST SITE: OATS
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)
INPUT VOLTAGE: 85% Unom



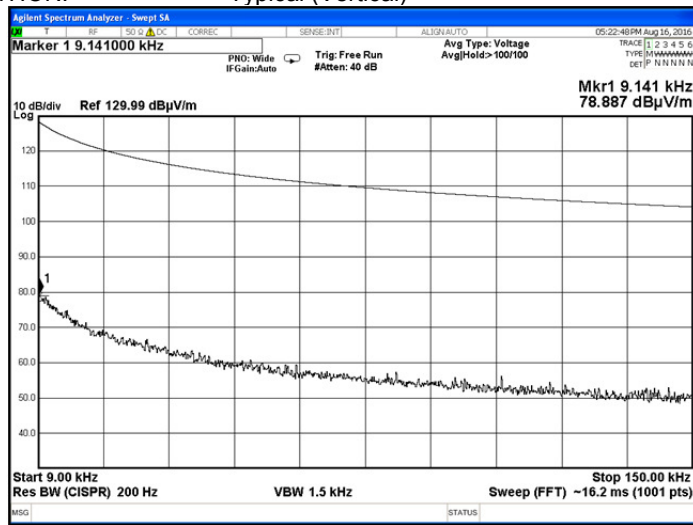


HERMON LABORATORIES

| | | | |
|---|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(b), Field strength of emissions | | | |
| Test procedure: ANSI C63.10 sections 6.5, 6.6 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 21-Aug-16 | | | |
| Temperature: 27 °C | Relative Humidity: 52 % | Air Pressure: 1008 hPa | Power: 120 VAC |
| Remarks: | | | |

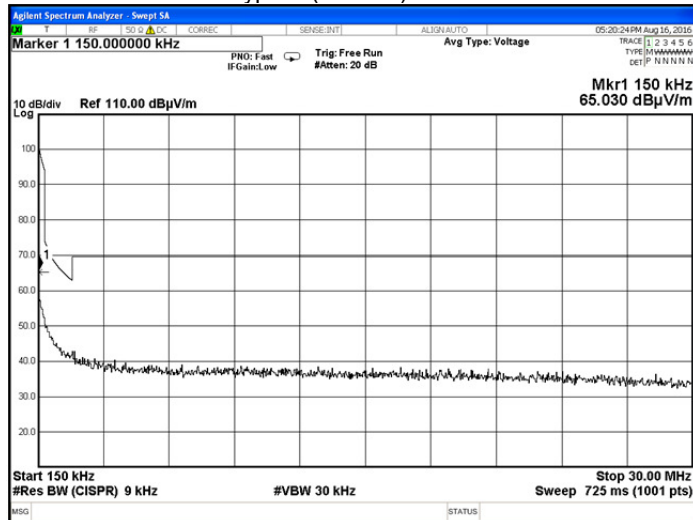
Plot 7.2.7 Radiated emission measurements from 9 to 150 kHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)



Plot 7.2.8 Radiated emission measurements from 0.15 to 30 MHz

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)



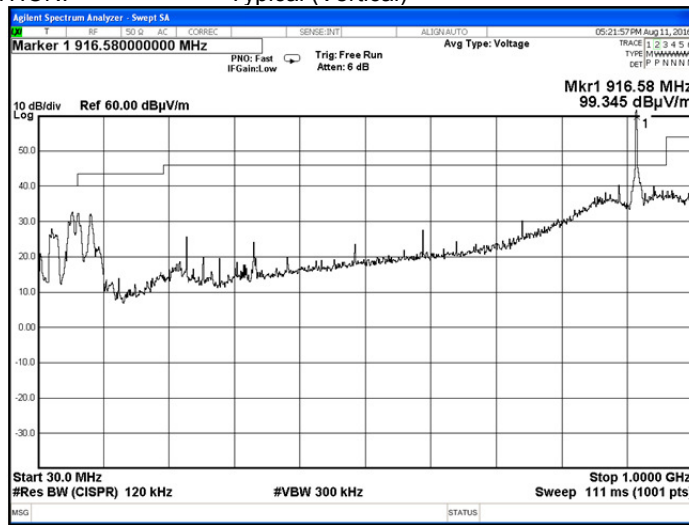


HERMON LABORATORIES

| | | | |
|---|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(b), Field strength of emissions | | | |
| Test procedure: ANSI C63.10 sections 6.5, 6.6 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 21-Aug-16 | | | |
| Temperature: 27 °C | Relative Humidity: 52 % | Air Pressure: 1008 hPa | Power: 120 VAC |
| Remarks: | | | |

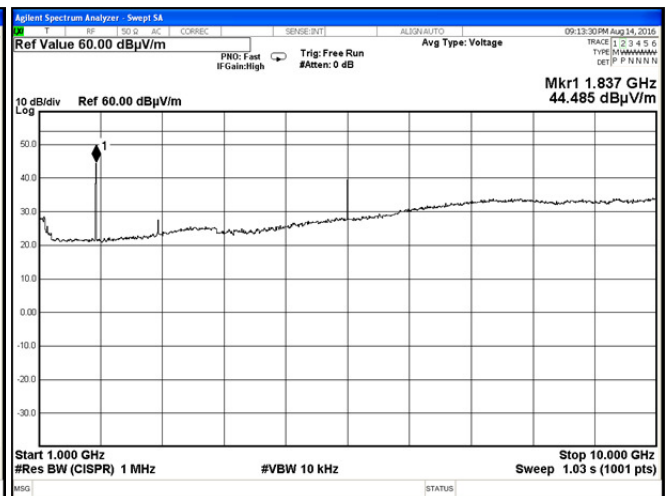
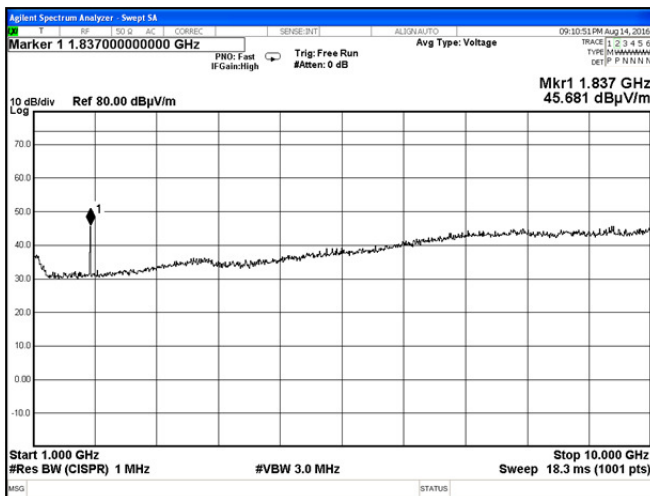
Plot 7.2.9 Radiated emission measurements from 30 to 1000 MHz

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical and Horizontal
 EUT POSITION: Typical (Vertical)



Plot 7.2.10 Radiated emission measurements from 1000 to 10000 MHz

TEST SITE: Semi anechoic chamber
 TEST DISTANCE: 3 m
 ANTENNA POLARIZATION: Vertical and Horizontal
 EUT POSITION: Typical (Vertical)



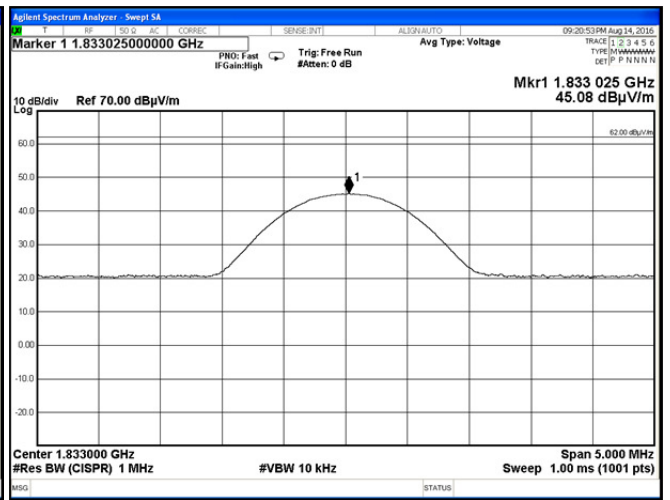
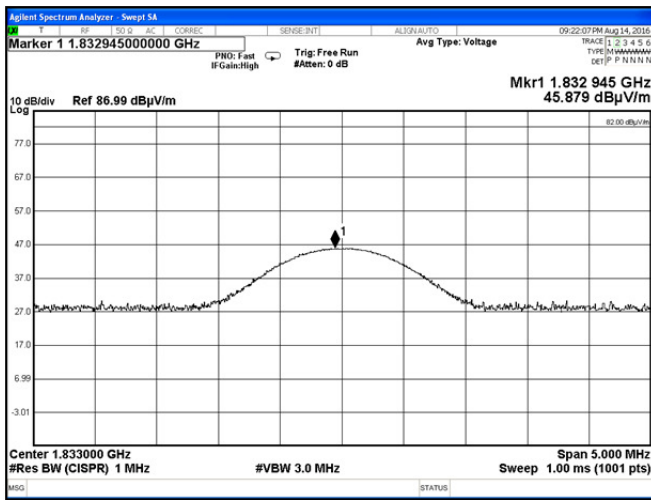


HERMON LABORATORIES

| | | | |
|---|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(b), Field strength of emissions | | | |
| Test procedure: ANSI C63.10 sections 6.5, 6.6 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 21-Aug-16 | | | |
| Temperature: 27 °C | Relative Humidity: 52 % | Air Pressure: 1008 hPa | Power: 120 VAC |
| Remarks: | | | |

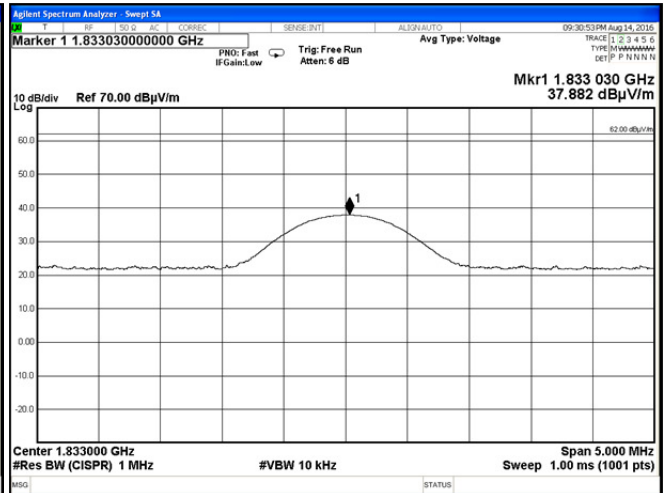
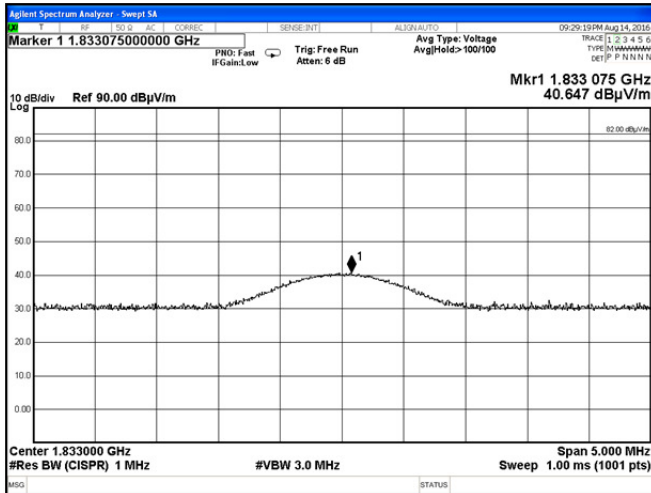
Plot 7.2.11 Radiated emission measurements at the second harmonic frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)



Plot 7.2.12 Radiated emission measurements at the second harmonic frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)



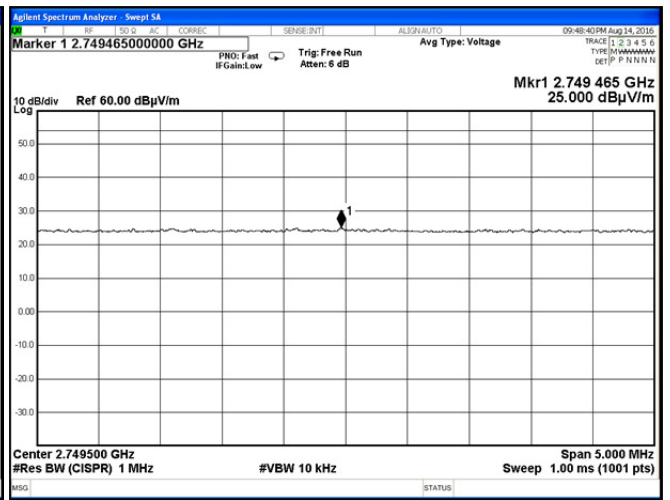
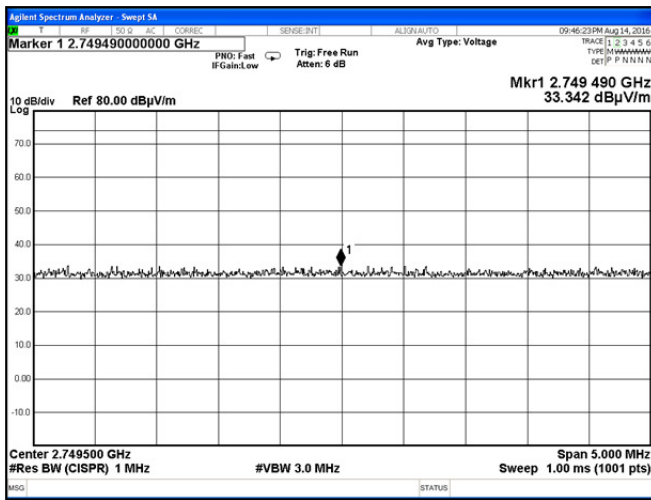


HERMON LABORATORIES

| | | | |
|---|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(b), Field strength of emissions | | | |
| Test procedure: ANSI C63.10 sections 6.5, 6.6 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 21-Aug-16 | | | |
| Temperature: 27 °C | Relative Humidity: 52 % | Air Pressure: 1008 hPa | Power: 120 VAC |
| Remarks: | | | |

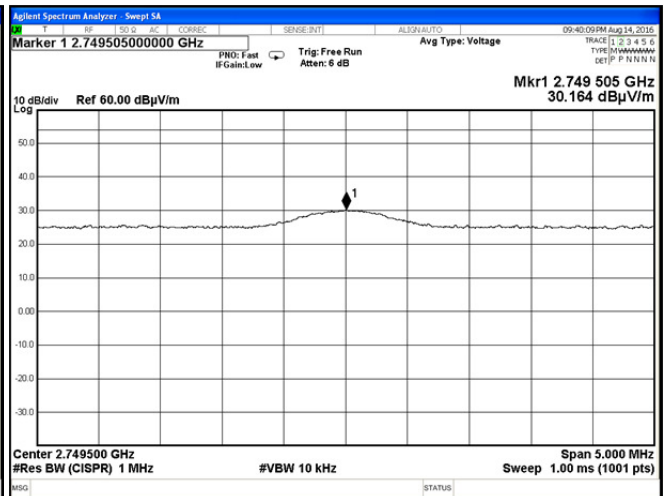
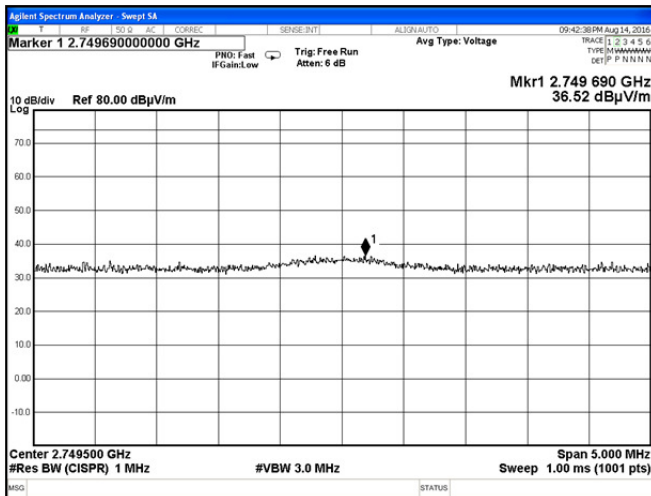
Plot 7.2.13 Radiated emission measurements at the third harmonic frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)



Plot 7.2.14 Radiated emission measurements at the third harmonic frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)



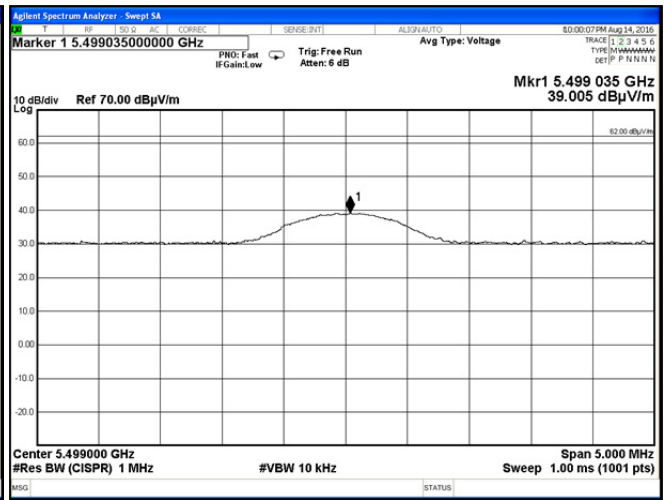
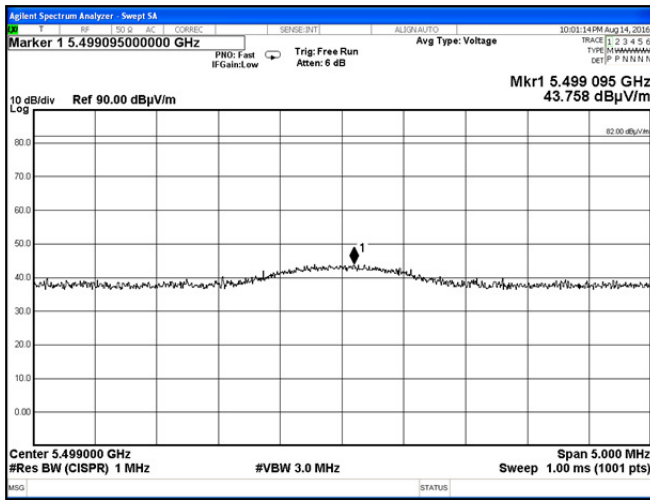


HERMON LABORATORIES

| | | | |
|---|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(b), Field strength of emissions | | | |
| Test procedure: ANSI C63.10 sections 6.5, 6.6 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 21-Aug-16 | | | |
| Temperature: 27 °C | Relative Humidity: 52 % | Air Pressure: 1008 hPa | Power: 120 VAC |
| Remarks: | | | |

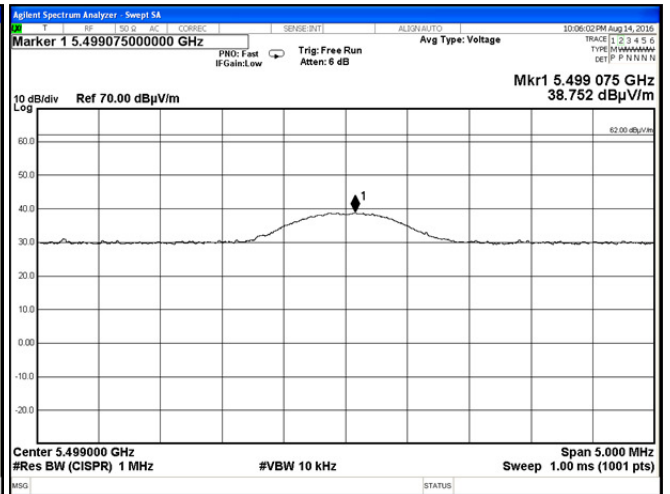
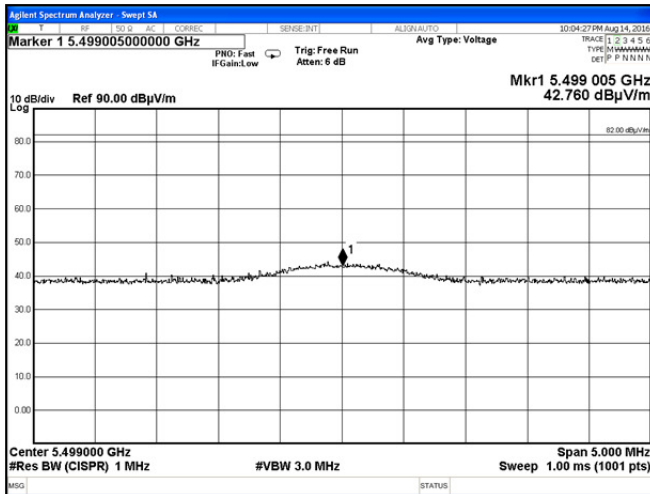
Plot 7.2.15 Radiated emission measurements at the sixth harmonic frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical
EUT POSITION: Typical (Vertical)



Plot 7.2.16 Radiated emission measurements at the sixth harmonic frequency

TEST SITE: Semi anechoic chamber
TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Horizontal
EUT POSITION: Typical (Vertical)

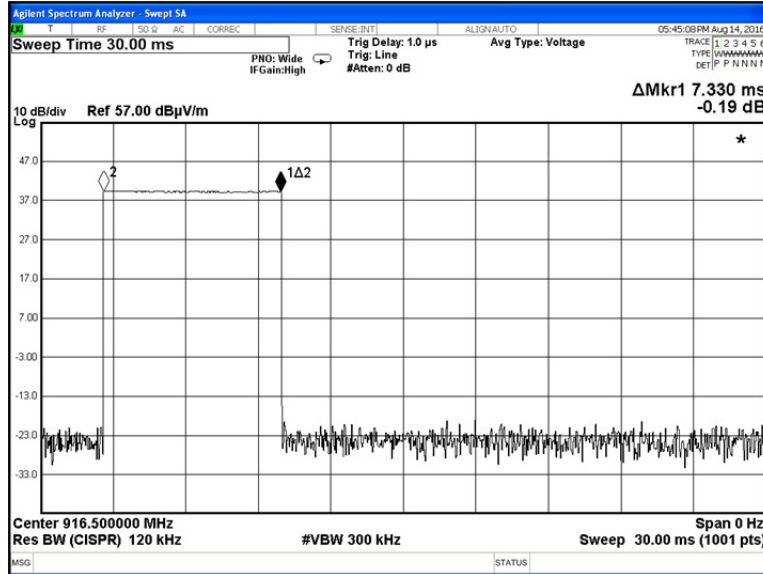




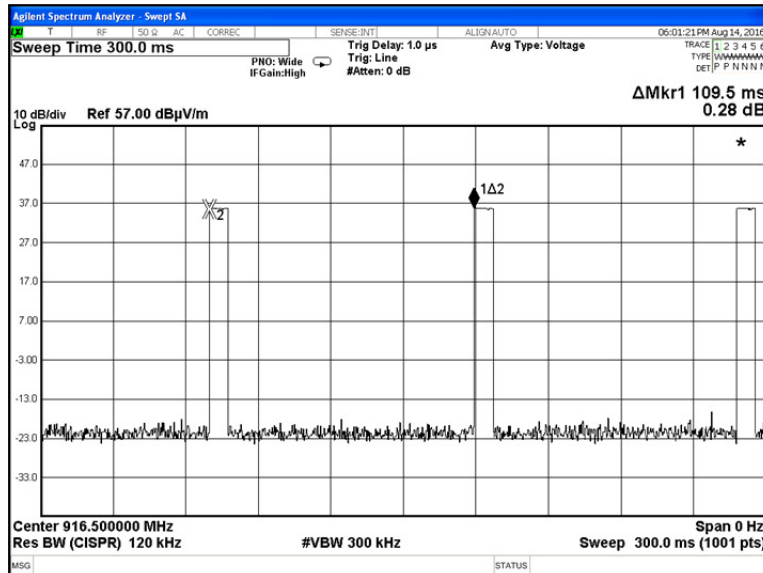
HERMON LABORATORIES

| | | | |
|---|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(b), Field strength of emissions | | | |
| Test procedure: ANSI C63.10 sections 6.5, 6.6 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 21-Aug-16 | | | |
| Temperature: 27 °C | Relative Humidity: 52 % | Air Pressure: 1008 hPa | Power: 120 VAC |
| Remarks: | | | |

Plot 7.2.17 Transmission pulse duration



Plot 7.2.18 Transmission pulse period





| | | | |
|--|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(c), Occupied bandwidth | | | |
| Test procedure: ANSI C63.10 section 6.9.2 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 18-Aug-16 | | | |
| Temperature: 25.8 °C | Relative Humidity: 52 % | Air Pressure: 1005 hPa | Power: 120 VAC |
| Remarks: | | | |

7.3 Occupied bandwidth test

7.3.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Occupied bandwidth limits

| Assigned frequency, MHz | Modulation envelope reference points*, dBc | Maximum allowed bandwidth, % of the carrier frequency |
|-------------------------|--|---|
| 70 - 900 | 20.0 | 0.25 |
| Above 900 | | 0.50 |

*- Modulation envelope reference points provided in terms of attenuation below modulated carrier.

7.3.2 Test procedure

7.3.2.1 The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.

7.3.2.2 The EUT was set to transmit modulated carrier.

7.3.2.3 The transmitter occupied bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.3.2 and associated plot.

Figure 7.3.1 Occupied bandwidth test setup





| | | | |
|--|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(c), Occupied bandwidth | | | |
| Test procedure: ANSI C63.10 section 6.9.2 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 18-Aug-16 | | | |
| Temperature: 25.8 °C | Relative Humidity: 52 % | Air Pressure: 1005 hPa | Power: 120 VAC |
| Remarks: | | | |

Table 7.3.2 Occupied bandwidth test results

DETECTOR USED: Peak hold
 RESOLUTION BANDWIDTH: 1 kHz
 VIDEO BANDWIDTH: 3 kHz
 MODULATION ENVELOPE REFERENCE POINTS: 20 dBc
 MODULATION: FSK
 BIT RATE: 38.4 kbps
 DETECTOR USED: Peak hold

| Carrier frequency, MHz | Occupied bandwidth, kHz | Limit | | Margin, kHz | Verdict |
|------------------------|-------------------------|----------------------------|--------|-------------|---------|
| | | % of the carrier frequency | kHz | | |
| 916.5 | 80.03 | 0.5 | 4582.5 | -4502.47 | Pass |

Reference numbers of test equipment used

| | | | | | | | | |
|---------|---------|---------|--|--|--|--|--|--|
| HL 4136 | HL 4274 | HL 4575 | | | | | | |
|---------|---------|---------|--|--|--|--|--|--|

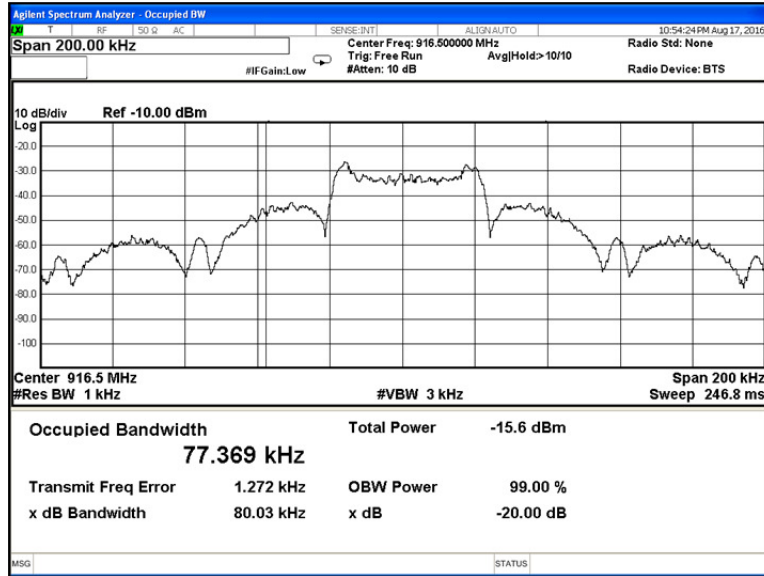
Full description is given in Appendix A.



HERMON LABORATORIES

| | | | |
|--|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 231(c), Occupied bandwidth | | | |
| Test procedure: ANSI C63.10 section 6.9.2 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 18-Aug-16 | | | |
| Temperature: 25.8 °C | Relative Humidity: 52 % | Air Pressure: 1005 hPa | Power: 120 VAC |
| Remarks: | | | |

Plot 7.3.1 Occupied bandwidth test result





| | | | |
|---|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 207, Conducted emission | | | |
| Test procedure: ANSI C63.10 section 6.2 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 22-Aug-16 | | | |
| Temperature: 26 °C | Relative Humidity: 40 % | Air Pressure: 1008 hPa | Power: 120 VAC |
| Remarks: | | | |

7.4 Conducted emissions

7.4.1 General

This test was performed to measure common mode conducted emissions at the power port. Specification test limits are given in Table 7.4.1.

Table 7.4.1 Limits for conducted emissions

| Frequency, MHz | Class B limit, dB(μV) | |
|----------------|-----------------------|----------|
| | QP | AVRG |
| 0.15 - 0.5 | 66 - 56* | 56 - 46* |
| 0.5 - 5.0 | 56 | 46 |
| 5.0 - 30 | 60 | 50 |

* - The limit decreases linearly with the logarithm of frequency.

7.4.2 Test procedure

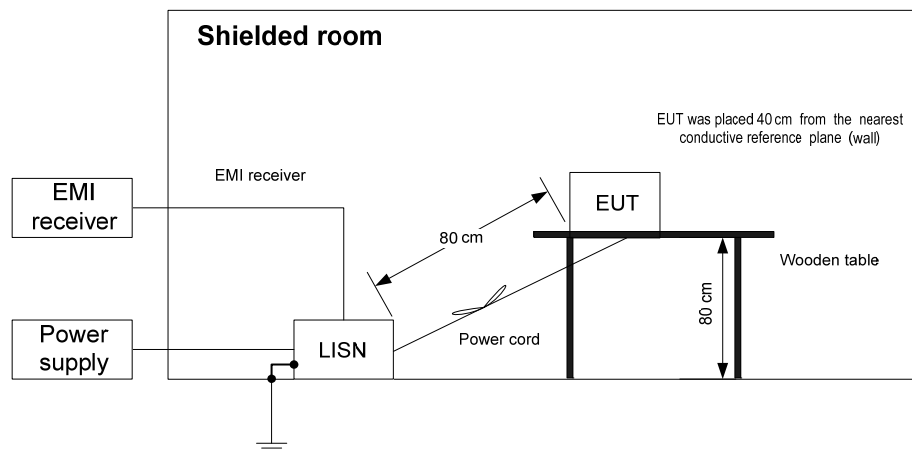
7.4.2.1 The EUT was set up as shown in Figure 7.4.1, energized and the performance check was conducted.

7.4.2.2 The measurements were performed at power terminals with the LISN, connected to a spectrum analyzer while unused coaxial connector of the LISN was terminated with 50 Ohm.

7.4.2.3 The position of the device cables was varied to determine maximum emission level.

7.4.2.4 The worst test results (the lowest margins) were recorded in Table 7.4.2 and shown in the associated plots.

Figure 7.4.1 Setup for conducted emission measurements, table-top equipment





| | | | |
|---|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 207, Conducted emission | | | |
| Test procedure: ANSI C63.10 section 6.2 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 22-Aug-16 | | | |
| Temperature: 26 °C | Relative Humidity: 40 % | Air Pressure: 1008 hPa | Power: 120 VAC |
| Remarks: | | | |

Table 7.4.2 Conducted emission test results

LINE: AC mains
 EUT OPERATING MODE: Transmit
 EUT SET UP: TABLE-TOP
 TEST SITE: SHIELDED ROOM
 FREQUENCY RANGE: 150 kHz - 30 MHz
 RESOLUTION BANDWIDTH: 9 kHz

| Frequency, MHz | Peak emission, dB(µV) | Quasi-peak | | | Average | | | Line ID | Verdict |
|----------------|-----------------------|---------------------------|---------------|-------------|---------------------------|---------------|-------------|---------|---------|
| | | Measured emission, dB(µV) | Limit, dB(µV) | Margin, dB* | Measured emission, dB(µV) | Limit, dB(µV) | Margin, dB* | | |
| 0.392 | 39.24 | 37.49 | 58.04 | -20.55 | 29.40 | 48.04 | -18.64 | L1 | Pass |
| 0.494 | 47.85 | 44.66 | 56.11 | -11.45 | 34.69 | 46.11 | -11.42 | | |
| 0.500 | 48.02 | 46.39 | 56.01 | -9.62 | 37.87 | 46.01 | -8.14 | | |
| 0.603 | 41.81 | 39.41 | 56.00 | -16.59 | 30.43 | 46.00 | -15.57 | | |
| 0.785 | 41.36 | 38.86 | 56.00 | -17.14 | 30.04 | 46.00 | -15.96 | | |
| 0.892 | 42.00 | 40.11 | 56.00 | -15.89 | 31.43 | 46.00 | -14.57 | | |
| 0.392 | 34.21 | 31.61 | 58.04 | -26.43 | 24.59 | 48.04 | -23.45 | L2 | Pass |
| 0.500 | 41.25 | 39.55 | 56.01 | -16.46 | 32.44 | 46.01 | -13.57 | | |
| 0.602 | 35.57 | 32.72 | 56.00 | -23.28 | 23.80 | 46.00 | -22.20 | | |
| 0.785 | 35.73 | 32.81 | 56.00 | -23.19 | 24.39 | 46.00 | -21.61 | | |
| 0.892 | 35.59 | 33.31 | 56.00 | -22.69 | 25.03 | 46.00 | -20.97 | | |
| 1.238 | 31.11 | 28.47 | 56.00 | -27.53 | 19.70 | 46.00 | -26.30 | | |

*- Margin = Measured emission - specification limit.

Reference numbers of test equipment used

| | | | | | | | |
|---------|---------|---------|---------|---------|---------|--|--|
| HL 0447 | HL 0787 | HL 1513 | HL 3612 | HL 4756 | HL 4778 | | |
|---------|---------|---------|---------|---------|---------|--|--|

Full description is given in Appendix A.



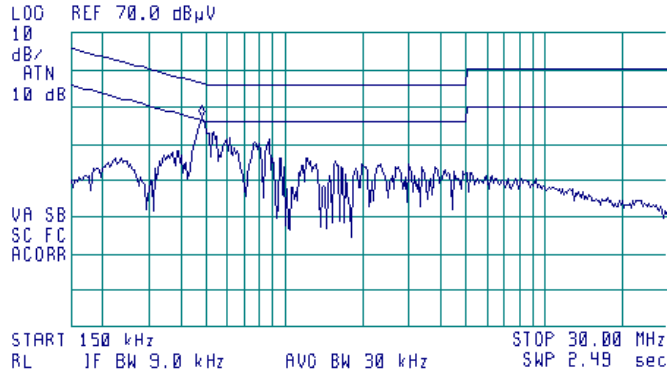
| | | | |
|---|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 207, Conducted emission | | | |
| Test procedure: ANSI C63.10 section 6.2 | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 22-Aug-16 | | | |
| Temperature: 26 °C | Relative Humidity: 40 % | Air Pressure: 1008 hPa | Power: 120 VAC |
| Remarks: | | | |

Plot 7.4.1 Conducted emission measurements

LINE: L1
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 480 kHz
47.48 dBµV

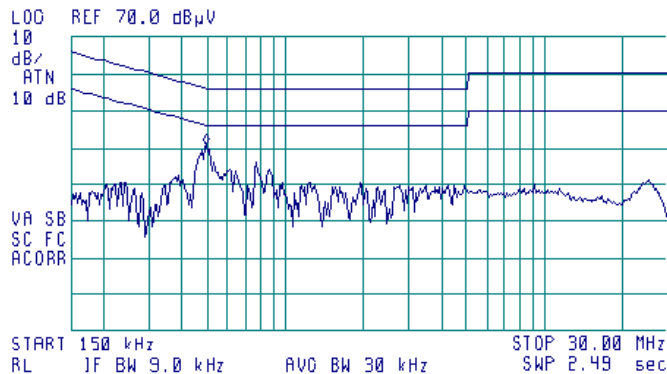


Plot 7.4.2 Conducted emission measurements

LINE: L2
EUT OPERATING MODE: Transmit
LIMIT: QUASI-PEAK, AVERAGE
DETECTOR: PEAK



ACTV DET: PEAK
MEAS DET: PEAK OP AVG
MKR 500 kHz
40.62 dBµV





| | | | |
|---|--------------------------------|-------------------------------|-----------------------|
| Test specification: FCC Part 15, Section 203, Antenna requirements | | | |
| Test procedure: Visual inspection / supplier declaration | | | |
| Test mode: Compliance | | Verdict: PASS | |
| Date(s): 18-Aug-16 | | | |
| Temperature: 24.8 °C | Relative Humidity: 50 % | Air Pressure: 1005 hPa | Power: 120 VAC |
| Remarks: | | | |

7.5 Antenna requirements

The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed for use with the EUT. This requirement does not apply to professionally installed transmitters. The rationale for compliance with the above requirements was either visual inspection results or supplier declaration. The summary of results is provided in Table 7.5.1.

Table 7.5.1 Antenna requirements

| Requirement | Rationale | Verdict |
|--|-------------------|---------|
| The transmitter antenna is permanently attached | Visual inspection | Comply |
| The transmitter employs a unique antenna connector | NA | |
| The transmitter requires professional installation | NA | |

Photograph 7.5.1 Antenna assembly



**8 APPENDIX A Test equipment and ancillaries used for tests**

| HL No | Description | Manufacturer | Model | Ser. No. | Last Cal./ Check | Due Cal./ Check |
|-------|---|-----------------------------|------------------|--------------|------------------|-----------------|
| 0415 | Cable, Coax, RF, RG-214, 12.3 m | Hermon Laboratories | CC-3 | 056 | 07-Dec-15 | 07-Dec-16 |
| 0447 | LISN, 16/2, 300V RMS, 50 Ohm/50 uH + 5 Ohm, STD CISPR 16-1 | Hermon Laboratories | LISN 16 - 1 | 066 | 13-Oct-15 | 13-Oct-16 |
| 0566 | Antenna, Biconical, 20 - 200 MHz | Electro-Metrics | BIA 25/30 | 3566 | 16-Mar-16 | 16-Mar-17 |
| 0583 | Antenna, Log Periodic, 200 - 1000 MHz | Hermon Laboratories | LP 200/1000 | 035 | 17-Mar-16 | 17-Mar-18 |
| 0787 | Transient Limiter 9 kHz-200 MHz | Hewlett Packard | 11947A | 3107A018 77 | 12-Oct-15 | 12-Oct-16 |
| 1513 | Cable RF, 8 m, BNC/BNC | Belden | M17/167 MIL-C-17 | 1513 | 08-Sep-16 | 08-Sep-17 |
| 1915 | Antenna, Loop, Active Receiving, 1 kHz - 30 MHz | EMC Test Systems | 6507 | 1457 | 18-Jan-16 | 18-Jan-17 |
| 2432 | Antenna, Double-Ridged Waveguide Horn 1 to 18 GHz | EMC Test Systems | 3115 | 00027177 | 28-Mar-16 | 28-Mar-17 |
| 2780 | EMC analyzer, 100 Hz to 26.5 GHz | Agilent Technologies | E7405A | MY451024 62 | 08-Sep-16 | 08-Sep-17 |
| 3612 | Cable RF, 17.5 m, N type-N type | Teldor | RG-214/U | NA | 07-Dec-15 | 07-Dec-16 |
| 4136 | Shield Box | TESCOM CO., LTD | TC-5916A | 5916A000 137 | 05-Apr-16 | 05-Apr-17 |
| 4274 | Test Cable , DC-18 GHz, 1.8 m, SMA/M - N/M | Mini-Circuits | CBL-6FT-SMNM+ | 70047 | 30-May-16 | 30-May-17 |
| 4294 | Microwave Cable Assembly, 18.0 GHz, 3.4 m, SMA/SMA | Huber-Suhner | Sucoflex P103 | NA | 07-Dec-15 | 07-Dec-16 |
| 4295 | Microwave Cable Assembly, 18.0 GHz, 3.4 m, SMA/SMA | Huber-Suhner | Sucoflex P103 | NA | 15-Dec-15 | 15-Dec-16 |
| 4535 | Microwave Cable Assembly, 6.5 GHz, 5.0 m, N/M type-N/M type | Suhner Switzerland | 214-U | NA | 30-May-16 | 30-May-17 |
| 4541 | Microwave Cable Assembly, 4.0 GHz, 1.0 m, N/M type-N/M type | Suhner Switzerland | 214-U | NA | 26-Aug-16 | 26-Aug-17 |
| 4542 | Amplifier, 9 kHz to 1 GHz, 32 dB gain | Sonoma Instrument | 310 | 0002A056 39 | 10-Mar-16 | 10-Mar-17 |
| 4543 | Broadband preamplifier, 0.5 to 18 GHz, 35 dB gain | Schwarzbeck mess-elektronik | BBV 9718 | 9718-134 | 03-Mar-16 | 03-Mar-17 |
| 4549 | Cable RF, 6.8 m, N/N - type, up to 3 GHz | Suhner Switzerland | NA | 07262 | 10-Mar-16 | 10-Mar-17 |
| 4551 | Cable RF, 6.6 m, N/N - type, up to 18 GHz | Suhner Switzerland | Sucoflex 104E | 22200/4E | 10-Mar-16 | 10-Mar-17 |
| 4575 | EXA Signal Analyzer, 9 kHz - 26.5 GHz | Agilent Technologies | N9010A | MY480301 10 | 17-Feb-16 | 17-Mar-17 |
| 4603 | Horn Antenna, 1 - 18 GHz | Schwarzbeck mess-elektronik | BBHA 9120 D | 9120D-611 | 18-Jun-16 | 18-Sep-17 |
| 4604 | Biconilog Antenna, 26 - 2000 MHz | EMCO | 3142B | 9909-1421 | 10-May-16 | 10-May-17 |



HERMON LABORATORIES

| HL No | Description | Manufacturer | Model | Ser. No. | Last Cal./ Check | Due Cal./ Check |
|-------|---|-----------------------------------|-----------|------------------------------------|------------------|-----------------|
| 4659 | EMC Anechoic Chamber (6.75 x 3.05 x 3.69) m | ETS Euroshield | Ft2000 | NA | NA | NA |
| 4663 | Spectrum Analyzer, 9 kHz - 1.5 GHz | Hewlett Packard | E7401A | US391501 41 | 23-Aug-16 | 23-Sep-17 |
| 4756 | Digital Hygrometer / Thermometer, (0 to +50) deg., (20 to 99) %RH | WESTERN Humidor Corporation | Caliber 4 | NA | 02-Nov-15 | 02-Nov-16 |
| 4778 | EMI Receiver, 9 kHz - 2.9 GHz, System: HL1431, HL4777 | Hewlett Packard | 8542E | 30807A00 262, 3427A001 23 | 05-Nov-15 | 05-Nov-16 |

9 APPENDIX B Measurement uncertainties

Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

| Test description | Expanded uncertainty |
|---|--|
| Conducted emissions with LISN | 9 kHz to 150 kHz: ± 3.9 dB 150 kHz to 30 MHz: ± 3.8 dB |
| Radiated emissions at 10 m measuring distance Horizontal polarization Vertical polarization | Biconilog antenna: ± 5.0 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.1 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 5.5 dB Biconical antenna: ± 5.5 dB Log periodic antenna: ± 5.6 dB Double ridged horn antenna: ± 5.8 dB |
| Radiated emissions at 3 m measuring distance Horizontal polarization Vertical polarization | Biconilog antenna: ± 5.3 dB Biconical antenna: ± 5.0 dB Log periodic antenna: ± 5.3 dB Double ridged horn antenna: ± 5.3 dB Biconilog antenna: ± 6.0 dB Biconical antenna: ± 5.7 dB Log periodic antenna: ± 6.0 dB Double ridged horn antenna: ± 6.0 dB |
| Conducted emissions at RF antenna connector | 9 kHz to 2.9 GHz: ± 2.6 dB 2.9 GHz to 6.46 GHz: ± 3.5 dB 6.46 GHz to 13.2 GHz: ± 4.3 dB 13.2 GHz to 22.0 GHz: ± 5.0 dB 22.0 GHz to 26.8 GHz: ± 5.5 dB 26.8 GHz to 40.0 GHz: ± 4.8 dB |
| Duty cycle, timing (Tx ON / OFF) and average factor measurements | ± 1.0 % |
| Occupied bandwidth | ± 8.0 % |

Hermon Laboratories is accredited by A2LA for calibration according to present requirements of ISO/IEC 17025 and NCSL Z540-1. The accreditation is granted to perform calibration of parameters that are listed in the Scope of Hermon Laboratories Accreditation.

Hermon Laboratories calibrates its reference and transfer standards by calibration laboratories accredited to ISO/IEC 17025 by a mutually recognized Accreditation Body or by a recognized national metrology institute. All reference and transfer standards used in the calibration system are traceable to national or international standards.

In-house calibration of all test and measurement equipment is performed on a regular basis according to Hermon Laboratories calibration procedures, manufacturer calibration/verification procedures or procedures defined in the relevant standards. The Hermon Laboratories test and measurement equipment is calibrated within the tolerances specified by the manufacturers and/or by the relevant standards.

10 APPENDIX C Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, safety, environmental and telecommunication testing facility.

Hermon Laboratories is recognized and accredited by the Federal Communications Commission (USA) for 1, 2, 15, 18 parts of Code of Federal Regulations 47 (CFR 47), Test Firm Registration Number is 927748, Designation Number is IL1001; registered by Industry Canada for electromagnetic emissions, file number IC 2186A-1 for OATS, certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, G-869 for RE measurements above 1 GHz, C-845 for conducted emissions site, T-1606 for conducted emissions at telecommunication ports). The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing and environmental simulation (for exact scope please refer to Certificate No. 839.01).

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11 APPENDIX D Specification references

| | |
|---------------------|---|
| 47CFR part 15: 2015 | Radio Frequency Devices. |
| ANSI C63.10: 2013 | American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices |
| ANSI C63.2: 1996 | American National Standard for Instrumentation-Electromagnetic Noise and Field Strength, 10 kHz to 40 GHz-Specifications. |
| ANSI C63.4: 2014 | American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz |



12 APPENDIX E Test equipment correction factors

Correction factor
Line impedance stabilization network
Model LISN 16 - 1
Hermon Laboratories, HL 0447

| Frequency, kHz | L1, dB | L2, dB |
|----------------|--------|--------|
| 150 | 0.11 | 0.09 |
| 170 | 0.10 | 0.08 |
| 200 | 0.09 | 0.07 |
| 250 | 0.08 | 0.07 |
| 300 | 0.07 | 0.06 |
| 350 | 0.07 | 0.06 |
| 400 | 0.08 | 0.05 |
| 500 | 0.07 | 0.05 |
| 600 | 0.07 | 0.05 |
| 700 | 0.06 | 0.06 |
| 800 | 0.07 | 0.05 |
| 900 | 0.07 | 0.05 |
| 1000 | 0.07 | 0.05 |
| 1200 | 0.08 | 0.05 |
| 1500 | 0.08 | 0.06 |
| 2000 | 0.08 | 0.06 |
| 2500 | 0.08 | 0.06 |
| 3000 | 0.09 | 0.07 |
| 4000 | 0.09 | 0.06 |
| 5000 | 0.10 | 0.08 |
| 7000 | 0.11 | 0.09 |
| 10000 | 0.14 | 0.12 |
| 15000 | 0.19 | 0.17 |
| 20000 | 0.26 | 0.24 |
| 30000 | 0.45 | 0.45 |

The correction factor in dB is to be added to meter readings of an interference analyzer or a spectrum analyzer.



**Antenna factor
Active loop antenna
EMC Test Systems
Model 6507, S/N 1457, HL 1915**

| Frequency, kHz | Measured antenna factor, dBS/m |
|----------------|--------------------------------|
| 10 | -22.7 |
| 20 | -27.6 |
| 50 | -31.3 |
| 75 | -31.8 |
| 100 | -32.2 |
| 150 | -32.3 |
| 250 | -32.6 |
| 500 | -32.8 |
| 750 | -33.0 |
| 1000 | -33.1 |
| 2000 | -33.4 |
| 3000 | -33.7 |
| 4000 | -34.0 |
| 5000 | -34.3 |
| 10000 | -34.9 |
| 15000 | -35.6 |
| 20000 | -35.9 |
| 25000 | -36.1 |
| 30000 | -36.7 |

The antenna factor shall be added to receiver reading in dB μ V to obtain field strength in dB μ A/m.



Antenna factor
Biconical antenna
Electro-Metrics, model BIA-25/30
Ser.No.3566, HL 0566

| Frequency MHz | Antenna Factor dB(1/m) | Frequency MHz | Antenna Factor dB(1/m) |
|---------------|------------------------|---------------|------------------------|
| 30 | 14.7 | 120 | 16.8 |
| 35 | 12.9 | 125 | 15.5 |
| 40 | 12.6 | 130 | 15.5 |
| 45 | 12.8 | 135 | 15.1 |
| 50 | 12.6 | 140 | 14.8 |
| 55 | 11.8 | 145 | 15.1 |
| 60 | 11.7 | 150 | 16.9 |
| 65 | 10.4 | 155 | 17.2 |
| 70 | 9.2 | 160 | 17.3 |
| 75 | 9.1 | 165 | 17.8 |
| 80 | 9.1 | 170 | 18.3 |
| 85 | 9.5 | 175 | 19.0 |
| 90 | 11.2 | 180 | 19.5 |
| 95 | 12.6 | 185 | 20.0 |
| 100 | 13.7 | 190 | 20.4 |
| 105 | 14.2 | 195 | 20.5 |
| 110 | 15.3 | 200 | 20.6 |
| 115 | 17.1 | | |

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to convert it into field strength in dB(μ V/m).



Antenna factor
Log periodic antenna
Hermon Laboratories, model LP 200/1000
Ser.No.035, HL 0583

| Frequency, MHz | Antenna factor, dB(1/m) |
|----------------|-------------------------|
| 200 | 12.0 |
| 250 | 12.5 |
| 300 | 14.5 |
| 350 | 15.7 |
| 400 | 16.0 |
| 450 | 16.7 |
| 500 | 18.1 |
| 550 | 18.2 |
| 600 | 18.8 |
| 650 | 20.1 |
| 700 | 21.8 |
| 750 | 21.4 |
| 800 | 21.4 |
| 850 | 22.4 |
| 900 | 22.8 |
| 950 | 23.4 |
| 1000 | 24.6 |

The antenna factor shall be added to receiver reading in dB μ V to obtain field strength in dB μ V/m.



Antenna factor
Double-ridged guide horn antenna
Model 3115, serial number: 00027177, HL 2432

| Frequency, MHz | Antenna factor. dB(1/m) |
|---------------------------|------------------------------------|
| 1000.0 | 24.7 |
| 1500.0 | 25.7 |
| 2000.0 | 27.8 |
| 2500.0 | 28.9 |
| 3000.0 | 30.7 |
| 3500.0 | 31.8 |
| 4000.0 | 33.0 |
| 4500.0 | 32.8 |
| 5000.0 | 34.2 |
| 5500.0 | 34.9 |
| 6000.0 | 35.2 |
| 6500.0 | 35.4 |
| 7000.0 | 36.3 |
| 7500.0 | 37.3 |
| 8000.0 | 37.5 |
| 8500.0 | 38.0 |
| 9000.0 | 38.3 |
| 9500.0 | 38.3 |
| 10000.0 | 38.7 |
| 10500.0 | 38.7 |
| 11000.0 | 38.9 |
| 11500.0 | 39.5 |
| 12000.0 | 39.5 |
| 12500.0 | 39.4 |
| 13000.0 | 40.5 |
| 13500.0 | 40.8 |
| 14000.0 | 41.5 |
| 14500.0 | 41.3 |
| 15000.0 | 40.2 |
| 15500.0 | 38.7 |
| 16000.0 | 38.5 |
| 16500.0 | 39.8 |
| 17000.0 | 41.9 |
| 17500.0 | 45.8 |
| 18000.0 | 49.1 |

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB(μ V) to convert it into field strength in dB(μ V/m).



Antenna factor
Horn antenna
Schwarzbeck mess-elektronik, Model BBHA 9120 D, serial number: 9120D-611, HL 4603

| Frequency, MHz | Measured antenna factor, dB/m |
|----------------|-------------------------------|
| 1000 | 25.2 |
| 1500 | 25.7 |
| 2000 | 26.1 |
| 2500 | 27.5 |
| 3000 | 28.3 |
| 3500 | 29.0 |
| 4000 | 30.0 |
| 4500 | 30.8 |
| 5000 | 31.9 |
| 5500 | 32.2 |
| 6000 | 33.1 |
| 6500 | 34.6 |
| 7000 | 35.9 |
| 7500 | 36.6 |
| 8000 | 37.2 |
| 8500 | 36.6 |
| 9000 | 36.9 |
| 9500 | 37.5 |
| 10000 | 38.4 |
| 10500 | 39.5 |
| 11000 | 40.3 |
| 11500 | 40.0 |
| 12000 | 39.2 |
| 12500 | 38.7 |
| 13000 | 39.6 |
| 13500 | 40.8 |
| 14000 | 41.6 |
| 14500 | 42.1 |
| 15000 | 41.2 |
| 15500 | 39.1 |
| 16000 | 38.5 |
| 16500 | 39.9 |
| 17000 | 41.0 |
| 17500 | 44.1 |
| 18000 | 55.6 |

The antenna factor shall be added to receiver reading in dB μ V to obtain field strength in dB μ V/m.



Antenna factor
Biconilog Antenna, 26 - 2000 MHz
EMCO, Model 3142B, serial number: 9909-1421, HL 4604

| Frequency, MHz | Measured, dB/m |
|----------------|----------------|
| 30 | 17.9 |
| 35 | 14.8 |
| 40 | 12.1 |
| 45 | 10.0 |
| 50 | 8.7 |
| 60 | 8.1 |
| 70 | 7.3 |
| 80 | 6.6 |
| 90 | 7.6 |
| 100 | 7.9 |
| 120 | 7.0 |
| 140 | 7.7 |
| 160 | 9.6 |
| 180 | 10.0 |
| 200 | 10.2 |
| 250 | 12.7 |
| 300 | 13.4 |
| 400 | 16.7 |
| 500 | 18.2 |
| 600 | 20.2 |
| 700 | 22.0 |
| 800 | 22.7 |
| 900 | 24.1 |
| 1000 | 25.0 |

The antenna factor shall be added to receiver reading in dB μ V to obtain field strength in dB μ V/m



Cable loss
Cable coax, RG-214, 12.3 m, s/n 056, HL 0415

| No. | Frequency, MHz | Cable loss, dB | Measured uncertainty, dB |
|-----|----------------|----------------|--------------------------|
| 1 | 10 | 0.23 | ±0.12 |
| 2 | 30 | 0.44 | ±0.12 |
| 3 | 50 | 0.60 | ±0.12 |
| 4 | 100 | 0.89 | ±0.12 |
| 5 | 150 | 1.11 | ±0.13 |
| 6 | 200 | 1.30 | ±0.13 |
| 7 | 250 | 1.45 | ±0.13 |
| 8 | 300 | 1.61 | ±0.13 |
| 9 | 400 | 1.94 | ±0.13 |
| 10 | 500 | 2.18 | ±0.13 |
| 11 | 600 | 2.45 | ±0.14 |
| 12 | 700 | 2.67 | ±0.14 |
| 13 | 800 | 2.94 | ±0.14 |
| 14 | 900 | 3.16 | ±0.14 |
| 15 | 1000 | 3.38 | ±0.14 |



Cable loss
Cable coaxial, RG-214/U, N type-N type, 17 m
Teldor, HL 3612

| Frequency, MHz | Measured, dB |
|----------------|--------------|
| 0.10 | 0.04 |
| 10.0 | 0.37 |
| 20.0 | 0.54 |
| 30.0 | 0.69 |
| 40.0 | 0.80 |
| 50 | 0.91 |
| 60 | 1.00 |
| 70 | 1.08 |
| 80 | 1.16 |
| 90 | 1.24 |
| 100 | 1.31 |
| 150 | 1.63 |
| 200 | 1.90 |
| 250 | 2.15 |
| 300 | 2.38 |
| 350 | 2.60 |
| 400 | 2.80 |
| 450 | 3.00 |
| 500 | 3.18 |
| 550 | 3.36 |
| 600 | 3.54 |
| 650 | 3.71 |
| 700 | 3.87 |
| 750 | 4.04 |
| 800 | 4.20 |
| 850 | 4.35 |
| 900 | 4.51 |
| 950 | 4.66 |
| 1000 | 4.81 |



Cable loss
Test cable, Mini-Circuits, S/N 70047, 18 GHz, 1.8 m, SMA/M - N/M
CBL-6FT-SMNM+, HL 4274

| Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 10 | 0.07 | 4800 | 1.69 | 9800 | 2.62 | 14800 | 3.42 |
| 30 | 0.11 | 4900 | 1.70 | 9900 | 2.63 | 14900 | 3.39 |
| 50 | 0.14 | 5000 | 1.72 | 10000 | 2.64 | 15000 | 3.38 |
| 100 | 0.21 | 5100 | 1.75 | 10100 | 2.64 | 15100 | 3.40 |
| 200 | 0.26 | 5200 | 1.76 | 10200 | 2.66 | 15200 | 3.41 |
| 300 | 0.30 | 5300 | 1.77 | 10300 | 2.67 | 15300 | 3.40 |
| 400 | 0.37 | 5400 | 1.79 | 10400 | 2.68 | 15400 | 3.39 |
| 500 | 0.44 | 5500 | 1.82 | 10500 | 2.68 | 15500 | 3.41 |
| 600 | 0.49 | 5600 | 1.85 | 10600 | 2.70 | 15600 | 3.44 |
| 700 | 0.54 | 5700 | 1.86 | 10700 | 2.71 | 15700 | 3.46 |
| 800 | 0.58 | 5800 | 1.87 | 10800 | 2.73 | 15800 | 3.45 |
| 900 | 0.63 | 5900 | 1.91 | 10900 | 2.74 | 15900 | 3.47 |
| 1000 | 0.67 | 6000 | 1.94 | 11000 | 2.76 | 16000 | 3.51 |
| 1100 | 0.71 | 6100 | 1.97 | 11100 | 2.77 | 16100 | 3.56 |
| 1200 | 0.75 | 6200 | 1.98 | 11200 | 2.78 | 16200 | 3.55 |
| 1300 | 0.78 | 6300 | 1.99 | 11300 | 2.79 | 16300 | 3.54 |
| 1400 | 0.81 | 6400 | 2.02 | 11400 | 2.80 | 16400 | 3.57 |
| 1500 | 0.85 | 6500 | 2.05 | 11500 | 2.82 | 16500 | 3.62 |
| 1600 | 0.88 | 6600 | 2.06 | 11600 | 2.83 | 16600 | 3.61 |
| 1700 | 0.91 | 6700 | 2.06 | 11700 | 2.84 | 16700 | 3.60 |
| 1800 | 0.94 | 6800 | 2.08 | 11800 | 2.85 | 16800 | 3.62 |
| 1900 | 0.97 | 6900 | 2.10 | 11900 | 2.87 | 16900 | 3.68 |
| 2000 | 1.00 | 7000 | 2.12 | 12000 | 2.88 | 17000 | 3.70 |
| 2100 | 1.03 | 7100 | 2.12 | 12100 | 2.89 | 17100 | 3.68 |
| 2200 | 1.06 | 7200 | 2.13 | 12200 | 2.90 | 17200 | 3.70 |
| 2300 | 1.08 | 7300 | 2.16 | 12300 | 2.92 | 17300 | 3.80 |
| 2400 | 1.11 | 7400 | 2.19 | 12400 | 2.94 | 17400 | 3.84 |
| 2500 | 1.14 | 7500 | 2.22 | 12500 | 2.95 | 17500 | 3.83 |
| 2600 | 1.16 | 7600 | 2.23 | 12600 | 2.96 | 17600 | 3.83 |
| 2700 | 1.19 | 7700 | 2.26 | 12700 | 2.98 | 17700 | 3.86 |
| 2800 | 1.21 | 7800 | 2.30 | 12800 | 3.00 | 17800 | 3.86 |
| 2900 | 1.27 | 7900 | 2.33 | 12900 | 3.02 | 17900 | 3.80 |
| 3000 | 1.29 | 8000 | 2.35 | 13000 | 3.03 | 18000 | 3.79 |
| 3100 | 1.32 | 8100 | 2.37 | 13100 | 3.06 | | |
| 3200 | 1.35 | 8200 | 2.41 | 13200 | 3.08 | | |
| 3300 | 1.37 | 8300 | 2.44 | 13300 | 3.09 | | |
| 3400 | 1.38 | 8400 | 2.47 | 13400 | 3.10 | | |
| 3500 | 1.41 | 8500 | 2.48 | 13500 | 3.13 | | |
| 3600 | 1.43 | 8600 | 2.51 | 13600 | 3.17 | | |
| 3700 | 1.46 | 8700 | 2.53 | 13700 | 3.17 | | |
| 3800 | 1.47 | 8800 | 2.55 | 13800 | 3.18 | | |
| 3900 | 1.49 | 8900 | 2.56 | 13900 | 3.22 | | |
| 4000 | 1.52 | 9000 | 2.57 | 14000 | 3.26 | | |
| 4100 | 1.55 | 9100 | 2.58 | 14100 | 3.28 | | |
| 4200 | 1.56 | 9200 | 2.59 | 14200 | 3.30 | | |
| 4300 | 1.58 | 9300 | 2.59 | 14300 | 3.35 | | |
| 4400 | 1.60 | 9400 | 2.60 | 14400 | 3.39 | | |
| 4500 | 1.63 | 9500 | 2.60 | 14500 | 3.39 | | |
| 4600 | 1.65 | 9600 | 2.61 | 14600 | 3.39 | | |
| 4700 | 1.67 | 9700 | 2.61 | 14700 | 3.41 | | |



Cable loss
Microwave Cable Assembly, 18.0 GHz, 3.4 m, SMA/SMA, Huber-Suhner,
Sucoflex P103, HL 4294

| Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 10 | 0.11 | 4900 | 2.09 | 10000 | 2.90 | 15100 | 3.61 |
| 30 | 0.17 | 5000 | 2.10 | 10100 | 2.92 | 15200 | 3.67 |
| 50 | 0.22 | 5100 | 2.14 | 10200 | 2.95 | 15300 | 3.63 |
| 100 | 0.30 | 5200 | 2.16 | 10300 | 2.96 | 15400 | 3.64 |
| 200 | 0.42 | 5300 | 2.17 | 10400 | 2.99 | 15500 | 3.68 |
| 300 | 0.51 | 5400 | 2.19 | 10500 | 2.99 | 15600 | 3.71 |
| 400 | 0.59 | 5500 | 2.19 | 10600 | 3.03 | 15700 | 3.74 |
| 500 | 0.66 | 5600 | 2.22 | 10700 | 3.03 | 15800 | 3.71 |
| 600 | 0.72 | 5700 | 2.24 | 10800 | 3.04 | 15900 | 3.74 |
| 700 | 0.77 | 5800 | 2.23 | 10900 | 3.05 | 16000 | 3.71 |
| 800 | 0.82 | 5900 | 2.26 | 11000 | 3.09 | 16100 | 3.73 |
| 900 | 0.88 | 6000 | 2.27 | 11100 | 3.07 | 16200 | 3.76 |
| 1000 | 0.93 | 6100 | 2.26 | 11200 | 3.08 | 16300 | 3.82 |
| 1100 | 0.98 | 6200 | 2.29 | 11300 | 3.11 | 16400 | 3.90 |
| 1200 | 1.02 | 6300 | 2.30 | 11400 | 3.12 | 16500 | 3.81 |
| 1300 | 1.06 | 6400 | 2.34 | 11500 | 3.11 | 16600 | 3.88 |
| 1400 | 1.10 | 6500 | 2.34 | 11600 | 3.15 | 16700 | 3.87 |
| 1500 | 1.14 | 6600 | 2.36 | 11700 | 3.16 | 16800 | 3.89 |
| 1600 | 1.19 | 6700 | 2.36 | 11800 | 3.18 | 16900 | 3.95 |
| 1700 | 1.23 | 6800 | 2.39 | 11900 | 3.19 | 17000 | 4.02 |
| 1800 | 1.27 | 6900 | 2.39 | 12000 | 3.23 | 17100 | 4.04 |
| 1900 | 1.30 | 7000 | 2.44 | 12100 | 3.25 | 17200 | 3.99 |
| 2000 | 1.35 | 7100 | 2.46 | 12200 | 3.22 | 17300 | 4.03 |
| 2100 | 1.38 | 7200 | 2.44 | 12300 | 3.25 | 17400 | 4.03 |
| 2200 | 1.42 | 7300 | 2.48 | 12400 | 3.25 | 17500 | 4.06 |
| 2300 | 1.45 | 7400 | 2.47 | 12500 | 3.28 | 17600 | 4.05 |
| 2400 | 1.48 | 7500 | 2.48 | 12600 | 3.27 | 17700 | 4.12 |
| 2500 | 1.51 | 7600 | 2.50 | 12700 | 3.27 | 17800 | 4.14 |
| 2600 | 1.55 | 7700 | 2.53 | 12800 | 3.30 | 17900 | 4.18 |
| 2700 | 1.59 | 7800 | 2.56 | 12900 | 3.30 | 18000 | 4.14 |
| 2800 | 1.62 | 7900 | 2.55 | 13000 | 3.27 | | |
| 2900 | 1.65 | 8000 | 2.56 | 13100 | 3.32 | | |
| 3000 | 1.66 | 8100 | 2.56 | 13200 | 3.32 | | |
| 3100 | 1.69 | 8200 | 2.57 | 13300 | 3.32 | | |
| 3200 | 1.71 | 8300 | 2.59 | 13400 | 3.35 | | |
| 3300 | 1.74 | 8400 | 2.62 | 13500 | 3.38 | | |
| 3400 | 1.76 | 8500 | 2.67 | 13600 | 3.39 | | |
| 3500 | 1.78 | 8600 | 2.65 | 13700 | 3.42 | | |
| 3600 | 1.80 | 8700 | 2.68 | 13800 | 3.47 | | |
| 3700 | 1.85 | 8800 | 2.68 | 13900 | 3.45 | | |
| 3800 | 1.88 | 8900 | 2.68 | 14000 | 3.49 | | |
| 3900 | 1.90 | 9000 | 2.74 | 14100 | 3.50 | | |
| 4000 | 1.91 | 9100 | 2.74 | 14200 | 3.55 | | |
| 4100 | 1.93 | 9200 | 2.76 | 14300 | 3.59 | | |
| 4200 | 1.96 | 9300 | 2.78 | 14400 | 3.58 | | |
| 4300 | 1.97 | 9400 | 2.79 | 14500 | 3.56 | | |
| 4400 | 1.99 | 9500 | 2.80 | 14600 | 3.57 | | |
| 4500 | 2.02 | 9600 | 2.83 | 14700 | 3.57 | | |
| 4600 | 2.02 | 9700 | 2.84 | 14800 | 3.57 | | |
| 4700 | 2.04 | 9800 | 2.86 | 14900 | 3.64 | | |
| 4800 | 2.05 | 9900 | 2.92 | 15000 | 3.64 | | |



Cable loss
Microwave Cable Assembly, 18.0 GHz, 3.4 m, SMA/SMA, Huber-Suhner, S/N 4295,
Sucoflex P103, HL 4295

| Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 10 | 0.11 | 5000 | 2.09 | 10200 | 2.97 | 15400 | 3.63 |
| 30 | 0.18 | 5100 | 2.12 | 10300 | 3.01 | 15500 | 3.65 |
| 50 | 0.23 | 5200 | 2.13 | 10400 | 3.00 | 15600 | 3.63 |
| 100 | 0.31 | 5300 | 2.16 | 10500 | 3.05 | 15700 | 3.64 |
| 200 | 0.38 | 5400 | 2.19 | 10600 | 3.09 | 15800 | 3.64 |
| 300 | 0.43 | 5500 | 2.21 | 10700 | 3.05 | 15900 | 3.66 |
| 400 | 0.52 | 5600 | 2.21 | 10800 | 3.09 | 16000 | 3.71 |
| 500 | 0.60 | 5700 | 2.24 | 10900 | 3.10 | 16100 | 3.67 |
| 600 | 0.67 | 5800 | 2.24 | 11000 | 3.08 | 16200 | 3.71 |
| 700 | 0.72 | 5900 | 2.25 | 11100 | 3.11 | 16300 | 3.70 |
| 800 | 0.78 | 6000 | 2.27 | 11200 | 3.12 | 16400 | 3.71 |
| 900 | 0.83 | 6100 | 2.25 | 11300 | 3.12 | 16500 | 3.72 |
| 1000 | 0.89 | 6200 | 2.29 | 11400 | 3.20 | 16600 | 3.84 |
| 1100 | 0.94 | 6300 | 2.34 | 11500 | 3.16 | 16700 | 3.78 |
| 1200 | 0.98 | 6400 | 2.37 | 11600 | 3.16 | 16800 | 3.85 |
| 1300 | 1.03 | 6500 | 2.33 | 11700 | 3.20 | 16900 | 3.88 |
| 1400 | 1.06 | 6600 | 2.34 | 11800 | 3.19 | 17000 | 3.85 |
| 1500 | 1.11 | 6700 | 2.39 | 11900 | 3.21 | 17100 | 3.88 |
| 1600 | 1.14 | 6800 | 2.46 | 12000 | 3.28 | 17200 | 3.92 |
| 1700 | 1.19 | 6900 | 2.45 | 12100 | 3.23 | 17300 | 3.90 |
| 1800 | 1.22 | 7000 | 2.44 | 12200 | 3.26 | 17400 | 4.00 |
| 1900 | 1.26 | 7100 | 2.43 | 12300 | 3.30 | 17500 | 4.02 |
| 2000 | 1.30 | 7200 | 2.44 | 12400 | 3.25 | 17600 | 4.00 |
| 2100 | 1.34 | 7300 | 2.51 | 12500 | 3.26 | 17700 | 3.96 |
| 2200 | 1.37 | 7400 | 2.54 | 12600 | 3.30 | 17800 | 4.01 |
| 2300 | 1.40 | 7500 | 2.49 | 12700 | 3.26 | 17900 | 4.02 |
| 2400 | 1.44 | 7600 | 2.52 | 12800 | 3.34 | 18000 | 4.08 |
| 2500 | 1.47 | 7700 | 2.59 | 12900 | 3.37 | | |
| 2600 | 1.50 | 7800 | 2.57 | 13000 | 3.30 | | |
| 2700 | 1.55 | 7900 | 2.55 | 13100 | 3.35 | | |
| 2800 | 1.58 | 8000 | 2.57 | 13200 | 3.31 | | |
| 2900 | 1.60 | 8100 | 2.58 | 13300 | 3.33 | | |
| 3000 | 1.63 | 8200 | 2.64 | 13400 | 3.42 | | |
| 3100 | 1.64 | 8300 | 2.70 | 13500 | 3.43 | | |
| 3200 | 1.67 | 8400 | 2.65 | 13600 | 3.40 | | |
| 3300 | 1.69 | 8500 | 2.66 | 13700 | 3.47 | | |
| 3400 | 1.73 | 8600 | 2.68 | 13800 | 3.45 | | |
| 3500 | 1.74 | 8700 | 2.70 | 13900 | 3.43 | | |
| 3600 | 1.76 | 8800 | 2.74 | 14000 | 3.52 | | |
| 3700 | 1.79 | 8900 | 2.74 | 14100 | 3.51 | | |
| 3800 | 1.82 | 9000 | 2.76 | 14200 | 3.54 | | |
| 3900 | 1.85 | 9100 | 2.82 | 14300 | 3.55 | | |
| 4000 | 1.87 | 9200 | 2.79 | 14400 | 3.52 | | |
| 4100 | 1.90 | 9300 | 2.82 | 14500 | 3.52 | | |
| 4200 | 1.92 | 9400 | 2.83 | 14600 | 3.56 | | |
| 4300 | 1.93 | 9500 | 2.83 | 14700 | 3.55 | | |
| 4400 | 1.94 | 9600 | 2.86 | 14800 | 3.55 | | |
| 4500 | 1.97 | 9700 | 2.93 | 14900 | 3.59 | | |
| 4600 | 1.99 | 9800 | 2.89 | 15000 | 3.56 | | |
| 4700 | 2.01 | 9900 | 2.91 | 15100 | 3.59 | | |
| 4800 | 2.02 | 10000 | 2.94 | 15200 | 3.59 | | |
| 4900 | 2.04 | 10100 | 2.94 | 15300 | 3.59 | | |



Cable loss
Microwave Cable Assembly, 6.5 GHz, 5.0 m, N/M type-N/M type
Suhner Switzerland, HL 4535

| Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB |
|----------------|----------------|----------------|----------------|----------------|----------------|
| 10 | 0.10 | 1700 | 1.79 | 4400 | 3.53 |
| 15 | 0.13 | 1800 | 1.86 | 4500 | 3.60 |
| 20 | 0.15 | 1900 | 1.93 | 4600 | 3.72 |
| 30 | 0.18 | 2000 | 2.00 | 4700 | 3.80 |
| 40 | 0.21 | 2100 | 2.06 | 4800 | 3.87 |
| 50 | 0.24 | 2200 | 2.13 | 4900 | 3.94 |
| 60 | 0.26 | 2300 | 2.19 | 5000 | 3.99 |
| 70 | 0.29 | 2400 | 2.25 | 5100 | 4.06 |
| 80 | 0.31 | 2500 | 2.32 | 5200 | 4.12 |
| 90 | 0.33 | 2600 | 2.38 | 5300 | 4.17 |
| 100 | 0.35 | 2700 | 2.45 | 5400 | 4.25 |
| 150 | 0.43 | 2800 | 2.51 | 5500 | 4.31 |
| 200 | 0.50 | 2900 | 2.57 | 5600 | 4.40 |
| 300 | 0.63 | 3000 | 2.64 | 5700 | 4.47 |
| 400 | 0.74 | 3100 | 2.73 | 5800 | 4.54 |
| 500 | 0.85 | 3200 | 2.79 | 5900 | 4.64 |
| 600 | 0.94 | 3300 | 2.86 | 6000 | 4.73 |
| 700 | 1.03 | 3400 | 2.91 | 6100 | 4.79 |
| 800 | 1.12 | 3500 | 2.97 | 6200 | 4.89 |
| 900 | 1.20 | 3600 | 3.02 | 6300 | 5.00 |
| 1000 | 1.28 | 3700 | 3.07 | 6400 | 5.06 |
| 1100 | 1.35 | 3800 | 3.14 | 6500 | 5.13 |
| 1200 | 1.43 | 3900 | 3.20 | | |
| 1300 | 1.50 | 4000 | 3.25 | | |
| 1400 | 1.58 | 4100 | 3.32 | | |
| 1500 | 1.65 | 4200 | 3.38 | | |
| 1600 | 1.72 | 4300 | 3.46 | | |



Cable loss
Microwave Cable Assembly, 4.0 GHz, 1.0 m, N/M type-N/M type
Suhner Switzerland, HL 4541

| Frequency, MHz | Cable loss, dB | Frequency, MHz | Cable loss, dB |
|----------------|----------------|----------------|----------------|
| 10 | 0.02 | 1700 | 0.45 |
| 15 | 0.03 | 1800 | 0.46 |
| 20 | 0.03 | 1900 | 0.48 |
| 30 | 0.04 | 2000 | 0.49 |
| 40 | 0.04 | 2100 | 0.52 |
| 50 | 0.05 | 2200 | 0.54 |
| 60 | 0.06 | 2300 | 0.55 |
| 70 | 0.06 | 2400 | 0.56 |
| 80 | 0.07 | 2500 | 0.58 |
| 90 | 0.07 | 2600 | 0.59 |
| 100 | 0.08 | 2700 | 0.61 |
| 150 | 0.10 | 2800 | 0.63 |
| 200 | 0.12 | 2900 | 0.64 |
| 300 | 0.15 | 3000 | 0.67 |
| 400 | 0.18 | 3100 | 0.70 |
| 500 | 0.20 | 3200 | 0.74 |
| 600 | 0.23 | 3300 | 0.77 |
| 700 | 0.25 | 3400 | 0.80 |
| 800 | 0.28 | 3500 | 0.82 |
| 900 | 0.30 | 3600 | 0.86 |
| 1000 | 0.31 | 3700 | 0.88 |
| 1100 | 0.33 | 3800 | 0.94 |
| 1200 | 0.35 | 3900 | 0.95 |
| 1300 | 0.37 | 4000 | 0.99 |
| 1400 | 0.39 | | |
| 1500 | 0.41 | | |
| 1600 | 0.43 | | |



13 APPENDIX F Abbreviations and acronyms

| | |
|----------------|---|
| A | ampere |
| AC | alternating current |
| A/m | ampere per meter |
| AM | amplitude modulation |
| AVRG | average (detector) |
| cm | centimeter |
| dB | decibel |
| dBm | decibel referred to one milliwatt |
| dB(μ V) | decibel referred to one microvolt |
| dB(μ V/m) | decibel referred to one microvolt per meter |
| dB(μ A) | decibel referred to one microampere |
| DC | direct current |
| EIRP | equivalent isotropically radiated power |
| ERP | effective radiated power |
| EUT | equipment under test |
| F | frequency |
| GHz | gigahertz |
| GND | ground |
| H | height |
| HL | Hermon laboratories |
| Hz | hertz |
| k | kilo |
| kHz | kilohertz |
| LO | local oscillator |
| m | meter |
| MHz | megahertz |
| min | minute |
| mm | millimeter |
| ms | millisecond |
| μ s | microsecond |
| NA | not applicable |
| NB | narrow band |
| OATS | open area test site |
| Ω | Ohm |
| PM | pulse modulation |
| PS | power supply |
| ppm | part per million (10^{-6}) |
| QP | quasi-peak |
| RE | radiated emission |
| RF | radio frequency |
| rms | root mean square |
| Rx | receive |
| s | second |
| T | temperature |
| Tx | transmit |
| V | volt |
| WB | wideband |

END OF DOCUMENT